PROCEEDINGS

MINE INSPECTORS' INSTITUTE
of the
UNITED STATES OF AMERICA.

PROCEEDINGS

MINE INSPECTORS' INSTITUTE

OF THE

UNITED STATES OF AMERICA

JOPLIN, MO., JUNE, 1916

Application for Membership in the Mine Inspectors' Institute of the United States of America

I desire to be enrolled as a member of the

Mine Inspectors' Institute of the United States of America

and inclose herewith five dollars ($5.00) dues for one year, as provided in Article 3 of the constitution.

Name _____

Official title _____

Address _____

ARTICLE III

Section 1. The membership of this Institute shall consist of:

(a) The Charter Members, which shall include only those persons who received the card of invitation to be present at the Indianapolis Conference.

(b) All men commissioned by the State, Province or County to act as mine inspectors.

(c) All persons commissioned by the Federal Government as Director of the Bureau of Mines, Chiefs of divisions or sections of said Bureau, for the purpose of coal- and metal-mine inspection and investigation.

Section 2. The annual dues of all members shall be five dollars ($5.00), which will become due and must be paid to the secretary of the Institute on or before the date of the annual meeting.

Section 3. At the close of each annual meeting all members whose dues have not been paid shall be notified by the secretary of the amount of dues in arrears, and if after three months the dues are not paid the names of such as are delinquent shall be dropped from the roll of membership.

Section 4. Applications for membership must be made in writing to the secretary of the Institute prior to the annual meeting and must be accompanied by the proper credentials and the payment of one year's dues. All such applications for membership shall be referred to the committee on membership and presented to the Institute, and shall require a two-thirds vote of all the members present at said meeting for acceptance.

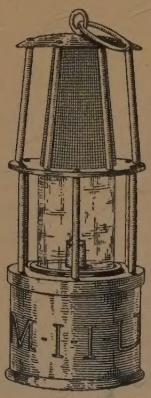
Section 5. Any member who has retired from active service as a state or provincial inspector may retain full membership by paying the regular annual dues and otherwise complying with the provisions of the constitution.

PROCEEDINGS

MINE INSPECTORS' INSTITUTE

OF THE

UNITED STATES OF AMERICA



9th

JOPLIN, MO., JUNE, 1916

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OFFICERS OF THE INSTITUTE

1916-1917

PRESIDENT

Thomas Graham.....Victoria, B. C.

FIRST VICE-PRESIDENT

L. D. Devore.....Bellaire, Ohio.

SECOND VICE-PRESIDENT

R. H. Beddow.....Gallup, N. M.

THIRD VICE-PRESIDENT

C. H. Nesbitt.....Birmingham, Ala.

SECRETARY

James W. Paul.....Empire Bldg., Pittsburgh, Penn.

ASSISTANT SECRETARY

Thomas Kanary.....St. Charles, Mich.

TREASURER

P. J. Moore.....Carbondale, Penn.

EDITOR-IN-CHIEF

James T. Beard.....New York, N. Y.

PAST OFFICERS

PRESIDENTS

*George Harrison (Ohio).....1908-11
John Laing (West Virginia).....1911-12
Thomas K. Adams (Pennsylvania).....1912-13
David J. Roderick (Pennsylvania).....1913-14
John Dunlop (Illinois).....1914-15
George E. Sylvester (Tennessee).....1915-16

FIRST VICE-PRESIDENTS

Thomas Moses (Illinois).....1908-11
James Taylor (Illinois).....1911-12
David J. Roderick (Pennsylvania).....1912-13
John Dunlop (Illinois).....1913-14
Joseph B. McDermott (Montana).....1914-15
Thomas Graham (British Columbia).....1915-16

SECOND VICE-PRESIDENTS

John Verner (Iowa).....1908-11
J. B. McDermott (Montana).....1911-12
Edward Flynn (Alabama).....1912-13
J. B. McDermott (Montana).....1913-14
George E. Sylvester (Tennessee).....1914-15
L. D. Devore (Ohio).....1915-16

THIRD VICE-PRESIDENTS

Robert Irving (Indiana).....1908-11
D. C. Botting (Washington).....1911-13
Thomas Morrison (Ohio).....1913-14
Thomas Graham (British Columbia).....1914-15
Rees H. Beddow (New Mexico).....1915-16

SECRETARY

James W. Paul (Pennsylvania).....1908-16

ASSISTANT SECRETARIES

P. A. Grady (West Virginia).....1908-11
F. W. Cunningham (Pennsylvania).....1911-12
Robert S. Wheatley (Ohio).....1912-16

TREASURERS

Thomas Hudson (Illinois).....1908-11
Thomas Morrison (Ohio).....1911-12
Rhys T. Rhys (Iowa).....1912-13
Robert Y. Muir (West Virginia).....1913-14
Joseph Knapper (Pennsylvania).....1914-15
Rhys T. Rhys (Iowa).....1915-16

EDITOR-IN-CHIEF

James T. Beard (New York).....1912-16

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*Deceased.

Executive Board Members

1916-1917

ALABAMA	Charles H. Nesbitt.	Birmingham
ALASKA	Summer S. Smith...	Juneau
COLORADO	M. J. McCarthy....	Cripple Creek
DISTRICT OF COLUMBIA	George S. Rice.....	Washington
ILLINOIS	David Z. Thrush...	Farmington
	John Dunlop.....	Peoria
	Thomas H. Devlin.	Assumption
INDIANA	*Michael Scollard...	Indianapolis
IOWA	William E. Holland	Albia
KANSAS	*John Pellegrino...	Pittsburg
KENTUCKY	Charles J. Norwood.	Lexington
MICHIGAN	Thomas Kanary....	St. Charles
MISSOURI	George Hill.....	Bevier
MONTANA	H. H. Pinkney.....	Bear Creek
NEW YORK	J. T. Beard.....	10th Ave. and 36th St., New York
OHIO	L. D. Devore.....	Bellaire
	*J. M. Roan.....	Columbus
OKLAHOMA	J. J. Rutledge.....	McAlester
PENNSYLVANIA		
Anthracite	D. J. Roderick.....	Hazleton
Bituminous	Thomas K. Adams.	Mercer
	*Joseph Knapper...	Philipsburg
	D. R. Blower.....	Scottdale
	Wm. H. Howarth..	Brownsville
TENNESSEE	George E. Sylvester.	Rockwood
TEXAS	I. J. Broman.....	Austin
WASHINGTON	*James Bagley.....	Seattle
WEST VIRGINIA	*E. J. Mason.....	Montgomery
BRITISH COLUMBIA	Robert Strachan...	Merritt
ONTARIO	James Bartlett.....	Haileybury

*Subject to ratification by vote of members.

LIST OF MEMBERS

June 15, 1916

ALABAMA

†Nesbitt, Charles H.....Birmingham
Hillman, Frank.....Mulga
Roscoe, Thomas.....Jasper
Groves, J. W., T. C. I. & R.R. Co.....Birmingham
*†Flynn, Edward.....Pratt City

ALASKA

Smith, Summer S.....Juneau
Maloney, William.....Nome

DISTRICT OF COLUMBIA

Rice, George S., Bureau of Mines.....Washington

COLORADO

McCarthy, M. J.....Cripple Creek

INDIANA

Wright, John C.....Boonville
†Scollard, Michael.....Indianapolis

ILLINOIS

***Rutledge, Walton**.....Alton
*†Dunlop, John.....Peoria
†Back, Thomas P.....Canton
Rosbottom, Frank.....West Frankfort
Thrush, David Z.....Farmington
Devlin, Thomas H.....Assumption
Bolt, Martin.....Springfield
Morgan, George L.....Pekin
Frew, Archibald.....Gillespie
Jones, John E.....Benton
†Reid, James S.....Carterville
Cartlidge, Oscar.....Springfield
†McClintock, John.....Murphysboro
Hartman, William.....Belleville
Starks, J. W.....Georgetown
†Bohlander, John.....Pekin
†Roberts, Ben. D.....Streator

IOWA

†Holland, William E.....Albia
Rhys, Rhys T.....Ottumwa

KANSAS

†Pellegrino, John.....Pittsburg
†Sherwood, James.....Pittsburg
†Paisley, Charles E.....Pittsburg
†Kotzman, Martin.....Frontenac

KENTUCKY

*Norwood, Charles J.....Lexington

MICHIGAN

Kanary, Thomas.....St. Charles

MISSOURI

†Hill, George.....Bevier
Detchmendy, R. C.....Flat River
†Harlan, C. M.....Carterville
†Fischer, Benjamin B.....Lexington
Jones, Evan.....Higbee
†Holmes, Walter W.....Webb City

MONTANA

Pinkney, H. H.....Bear Creek

NEW MEXICO

Rees H. Beddow.....Gallup

NEW YORK

*Beard, J. T., 10th Ave. and 36th St.....New York

OHIO

Devore, L. D. ..... Bellaire
Werker, William H. ..... Rayland
Burke, John ..... Wellston
Roan, J. M. ..... Columbus
Gaffney, Hugh ..... Bridgeport
Albaugh, Morris ..... Murray City
Grogan, Thomas F. ..... Hemlock
Lewis, Evan ..... Massillon
Collins, J. A. ..... Belle Valley
Sullivan, D. H. ..... Coshocton
Ginnan, Andrew ..... Jacksonville

OKLAHOMA

Rutledge, J. J. ..... McAlester
Boyle, Edward ..... Oklahoma City
Haley, Frank ..... Henryetta

PENNSYLVANIA (Anthracite)

Roderick, D. J. ..... Hazleton
Davis, D. T. ..... Wilkes-Barre
Price, C. J. ..... Lykens
Moore P. J. ..... Carbondale

(Bituminous)

*Adams, Thomas K. ..... Mercer
*Ross, C. B. ..... Latrobe
Girod, Edward E. ..... Masontown
*Blower, D. R. ..... Scottdale
Byrne, Charles P. ..... Charleroi
Callaghan P. J. ..... Bridgeville
Thompson, Thomas H. ..... Punxsutawney
Langan, William ..... Elizabeth
Stoker, James J. ..... Irwin
Phythyon, Harry ..... Belle Vernon
*Pratt, John I., 7740 Bennett St. ..... Pittsburgh
*Young, David ..... Freeport
*Bell, John F. ..... Dravosburg
Howarth, William H. ..... Brownsville
*Knapper, Joseph ..... Philipsburg
*Phillips, Elias ..... Du Bois
*Hall, Clarence, Empire Building ..... Pittsburgh
*†Paul, James W., Empire Building ..... Pittsburgh
Wilson, Herbert M., 524 Federal St. ..... Pittsburgh
Wolflin, Hugh M., Bureau of Mines ..... Pittsburgh
Davies, J. C. ..... Pittsburgh

TENNESSEE

†Sylvester, George E. ..... Rockwood

TEXAS

Broman, I. J. ..... Austin

WASHINGTON

Bagley, James ..... Seattle
Ash, Simon H. ..... Seattle

WEST VIRGINIA

Muir, R. Y. ..... Berwind
Mason, E. J. ..... Montgomery
Laing, John ..... Charleston

CANADA

British Columbia

†Graham, Thomas ..... Victoria
Strachan, Robert ..... Merritt

Ontario

Sutherland, T. J. ..... Toronto
†Bartlett, James ..... Haileybury
Collins, E. A. ..... Kingston

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*Charter member.
Life member indicated by heavy-faced type.
†In attendance, Joplin meeting.

FINANCIAL STATEMENT BY THE SECRETARY

1915-1916

Receipts

1915	
June 2 to Sept. 7, Dues for 1914-15	$90.00
1916	
Jan. 18 to June 1, Dues for 1915-16	225.00
May 16-19, Dues for 1916-17	10.00
Total receipts to June 1, 1916	$325.00
1916	
Apr. 25, Paid R. T. Rhys, Treas.	$200.00
June 1, Paid R. T. Rhys, Treas.	125.00
Total	$325.00

Expenditures

1915	
Aug. 10, Voucher No. 53, Pittsburgh Printing Co., Programs	$8.50
Nov. 22, Voucher No. 54, Hill Publishing Co., Proceedings, 1915	168.81
1916	
May 19, Voucher No. 55, Tanki Service Bureau, Forms, etc.	16.07
May 19, Voucher No. 56, Wm. G. Johnston Co., Printing	23.60
June 1, Voucher No. 57, J. W. Paul, Typewriting, postage, etc.	88.56
Total expenditures for 1915-16	$305.54

J. W. Paul,
Secretary.

June 1, 1916.

REPORT OF THE TREASURER

Receipts

1915	
July 17, Received from Joseph Knapper, Treas.	$237.67
1916	
May 3, Received from J. W. Paul, Sec.	200.00
June 6, Received from J. W. Paul, Sec.	125.00
Total receipts	$562.67

Expenditures

1915	
Aug. 10, Pittsburgh Printing Co., Voucher No. 53	$8.50
Nov. 22, Hill Publishing Co., Voucher No. 54..	168.81
1916	
May 19, Tanki Service Bureau, Voucher No. 55	16.07
May 19, W. G. Johnston Co., Voucher No. 56..	23.60
June 1, J. W. Paul, Voucher No. 57.....	88.56
Total expenditures	$305.54
Balance in Treasury, June 3, 1916.....	257.13
	$562.67

R. T. Rhys,
Treasurer.

June 6, 1916.

Report of the Auditing Committee

Members of the Mine Inspectors' Institute of the United States of America:

We, your committee on auditing, have examined the reports of the secretary and treasurer of the Institute and find the same to be correct.

C. H. Nesbitt, *Chairman,*
John Dunlop,
C. M. Harlan.

Joplin, Mo., June 15, 1916.

MINUTES OF THE NINTH ANNUAL MEETING MINE INSPECTORS' INSTITUTE OF THE UNITED STATES OF AMERICA

Held in the Conner Hotel, Joplin, Mo., June 13-15, 1916

Tuesday Afternoon, June 13, 1916

The meeting of the Institute was called to order at 2:00 p.m. by George Hill, chief mine inspector of Missouri, who, on behalf of his brother inspectors, welcomed the Institute to the State of Missouri. Mr. Hill then called to the chair the retiring president of the Institute, John Dunlop, of Illinois. On taking the chair, Mr. Dunlop introduced J. F. Lee, who was present to represent Mayor Hugh McIndoe and who welcomed the members of the Institute to the City of Joplin.

President George E. Sylvester, of Tennessee, then took the chair and after a few brief remarks appointed the committee on membership, consisting of George Hill, chairman, Edward Flynn and Thomas P. Back.

The secretary presented the list of applications for membership, which was delivered to the committee and a short recess taken pending their report. The committee on membership reported as follows:

Report of Committee on Membership

We, your committee on membership, report and recommend the following names for election to membership in the Institute:

M. J. McCarthy, State Mine Inspector, Colorado.
James Bagley, State Mine Inspector, Washington.
Simon H. Ash, Deputy State Inspector, Washington.
Hugh M. Wolfin, Mine Safety Engineer, Pennsylvania.
Frank Haley, State Mine Inspector, Oklahoma.
Wm. Maloney, U. S. Mine Inspector, Alaska.

George Hill, Chairman,
Edward Flynn,
Thomas P. Back.

Joplin, Mo., June 13, 1916.

On motion duly made and seconded, the report of the committee on membership was unanimously accepted and the persons named in the report voted members of the Institute. President Sylvester then delivered his address, which was well received and discussed by a number of the members present.

The President's Annual Address

Fellow Members of the Mine Inspectors' Institute of the United States of America:

I esteem it not only a great privilege but an honor to once more have the opportunity of meeting with you as a member of this organization. Although, as you may know, I am no longer in the active work of an inspector, I am still in full sympathy in the great movement that may be summed up as, greater safety in our mines.

It was with much regret that I had to deny myself the privilege of meeting with you last year at St. Louis and, as I did not have the opportunity then, I wish now to express my high appreciation of the great honor that you conferred upon me, in selecting me at that time as your president. I have felt, however, that it might have been better for our Institute, if a man had been selected for this high office who was to remain more in touch with the active work of mine inspection. Nevertheless, from my past experience, I feel that I am and always will be in full sympathy with the active inspector, both in respect to his ambitions and the solution of his problems.

From the previous meetings of this Institute that I have attended, I have returned home feeling that I had increased my knowledge of the difficult problems of mine-inspection work, and that I was better fitted to more successfully carry on my work for the coming year; and I think that no inspector can attend one of our meetings and conscientiously participate in the proceedings, without going back a more capable and efficient officer and a better man.

While the membership and influence of this Institute is such as to give encouragement to every member, I feel that it should be much greater. Mine-inspection work,

taken in the truest sense, is a highly specialized occupation, and requires more than a simple knowledge of mining practice. As our Institute represents, I believe, the highest authority in this line of work, I do not consider that any inspector who is earnestly endeavoring to obtain the highest possible degree of proficiency, can afford to refrain from associating himself with the organization, and taking his part in the proceedings. Other lines of specialization recognize the necessity of organization, and I feel that attendance on our Institute meetings should be more generally accepted as not only a privilege but one of the duties of every mine inspector.

Heretofore, although the metal-mine inspectors have been always welcome, the membership of the Institute has been largely confined to the coal-mine inspectors. While it is true that each class of mining has its individual problems, there is so much that is common in coal and metal mining that I feel that we can work together to our mutual interest and advantage. I hope to see an increased membership coming from the ranks of the metal-mine inspectors.

I will not at this time go into details of our latest mine statistics, or attempt any special review of the past year, as there are others here who are more capable of doing this. I wish, however, to express a few general thoughts, and if there should be among them anything that will, even in a slight degree, advance the cause of safety I shall be content.

That the general statistics of mine accidents are not as a whole entirely satisfactory may be conceded. Plans have been discussed, both in our meetings and elsewhere, having in view a more uniform and comprehensive system of conducting mining operations. These efforts, however, are all we have to mark our progress and show our advance along the lines of increased safety.

We all know that, for a number of years past, there has been an increasingly active movement for greater safety in mines. As a result, the danger of coal dust and its remedies are today better understood. The use of permissible powder is extending. A more active interest is being taken in many quarters in the safety-first and first-

aid movements, and various other similar reforms are in progress. While there is undoubtedly a slight general decrease of mine accidents, as shown by the statistics, it would not seem that this decrease has been as great as it should have been.

The question arises, are these reforms being generally applied in mining practice? Or, has an increased factor of danger, resulting either from the rapid development of our mines or from changed labor conditions, been introduced to partially counteract the movement for safety. I feel that this, at least, is a question on which opinions from some of our members would prove interesting.

It is necessary, if we are to endeavor to decrease our accident rate, to first inquire carefully into the cause of mine accidents. Referring again to our statistics, we find a careful and comprehensive classification of these accidents. This classification, however, deals with the technical, I might almost say the mechanical causes, and does not consider what to me seems more important the personal or human element concerned.

For instance, as we all know, nearly 50 per cent. of mine accidents come under the head of falls of roof and coal. This is subdivided, as falls of slate or coal, falls in rooms, in haulways, etc. Now falls are more or less common in coal mines. There are dozens, yes, hundreds of falls in mines where no one is hurt, and the incident is not even remembered, much less recorded. It is only where a man is caught and hurt or killed that the fall becomes an "accident." But, let me ask, what is the difference between the fall that catches a miner who thought he could load another car before setting a timber, and the fall that occurs while he is back in a place of safety preparing the timber? The physical conditions are the same, the difference is solely one of the human element, which does not appear in our statistics.

If we are really endeavoring to decrease these accidents there are a number of facts we should know. Was the accident due to ignorance, improper instructions, lack of instructions, disobedience of orders, lack of discipline, or simply the result of carelessness. Was it the fault of the management or the miner himself; or was it one

of those cases occurring much more rarely, where it would seem no human oversight could have prevented the accident, which must therefore be charged directly to the natural hazard of mining. I say "more rarely" advisedly, for in my experience the human element in most of these cases is the vital one.

The same question arises to a greater or less extent in the other classifications made, namely, explosives, haulage, electricity, etc. It is true that in some of these classifications more can be done in what we may consider a technical sense, that is to say, by providing a condition that will make it more difficult for an accident to occur, but even then the condition of ignorance or lack of discipline may interfere and upset all calculations.

I realize the difficulty in compiling such statistics. An operator will report "Fall of slate," "Delayed shot" or "Derailment of motor," for these are usually self-evident, and rarely have a special meaning when it comes to fixing the responsibility. On the other hand, to go into the question of the human element would probably react to the disadvantage of some of the parties concerned.

It is not, however, for placing the blame for the individual accident that this information would be valuable. In fact, if it were to be used for that purpose it might defeat any effort to compile the facts. If we want general remedies we must get general facts to start with, but they must be facts; and I venture to say that if it were possible to collect some correct statistics along this line, they would show startling results.

The primary duty of the mine inspector is supposed to be the enforcement of the mining law. If this constituted his only duty the problem would be much simplified, since every mine inspector has reason to know that a mere technical compliance with the mining law does not necessarily mean a safe mine.

As an illustration, I will assume two mines operated in the same field and working the same seam of coal, under practically the same natural conditions, say generally good top but treacherous in places. The mines have a tendency to dryness but are not difficult to keep clear of dust, while gas is found occasionally. In neither

of these mines does the inspector find, on his visit of inspection, any special disregard of the mining law. In the first mine, however, we will say he finds an operator who fully realizes the presence of a potential danger, and believes that safety can only be obtained at the price of eternal vigilance. He is a man who welcomes any suggestion in regard to safety, without a question as to whether or not it is the mining law, and one whom the inspector can feel assured will as faithfully carry out his suggestions, during the month or so of his absence, the same as on the day of inspection.

Now, contrast this with the second mine. The operator of this mine believes it to be entirely safe. He complies with the letter of the law because it is the law, but he feels that the law is oppressive and that the so-called safety movements are much overdone. This man is one with whom a suggestion for safety must be backed by the law in order to receive consideration.

While these two mines have been assumed, is there one present who has not come in contact with more or less similar cases? The inspector must keep himself abreast of the times or he will feel his limitations in the first case, while he must be possessed of an abundance of knowledge, force, judgment and tact, in order to make his influence felt in the second instance.

There are other matters that I would like to touch upon, but I feel that it is unnecessary, for we have on our program a number of interesting technical papers and subjects for discussion.

I feel that we are looking forward to an interesting and instructive meeting of the Institute, and trust it will be one from which we will go to our homes with new inspirations for the coming year and with pleasant memories of meeting old friends, and making many new acquaintances during the short time in which we are assembled in a common cause as mine inspectors.

A hearty vote of appreciation and thanks was extended to President Sylvester for his timely address, after which the following discussion took place:

Mr. Dunlop (*Illinois*)—I was just talking to my friend here from Victoria, as I thought he might be able to offer some comments on the president's address, but he said, "No, the president has made a mistake in not leaving a loophole that the members could start a discussion." I want to say, this is an admirable address and describes well the experiences that all inspectors meet in going through the mines.

It might not be out of place here to say that I am not a mine inspector any longer, but am glad to add that I am now making more mines than I did when I was a state inspector. I find that it is not only my duty in my present position to see that the mining laws are carried out, but at times I have to go just a little further. Mere compliance with the law does not cover all the details in the way of providing safety appliances for a mine, and that seems to be my principal duty now. I cover more territory as safety inspector than I did when a mine inspector.

While in a mine last week, I saw some places that I never saw before, although it was one of the mines I had inspected for several years. I presume that the reason is I have now another proposition in view and am working for the human element in the mine. Our work is to see that the man at the face is taking the proper precautions to protect himself. All of the mines I am serving are under the Workmen's Compensation Act, and it is my duty to show a low accident rate. I am satisfied that the state inspectors of Illinois find this quite a help where they have mines that employ safety inspectors. I have not lost interest in our Institute because I am no longer a state inspector, and have listened with much pleasure to the address of President Sylvester.

Mr. Reid (*Illinois*)—I was sorry to learn that Mr. Dunlop had to give up his work as state mine inspector. Safety inspectors are, however, a great help throughout the different inspection districts in Illinois.

It is probably true that in our state the mine inspectors have more territory than they can cover and do not therefore cover it as often as they should, and the "safety in-

spectors," as we call them, fill in and make up for this deficiency.

In my district there are two companies who employ safety inspectors and our fatal accidents are not as many as in the past, which is largely due to the help of these other inspectors. I think our president's address was good and hope to hear from other members.

Mr. Paul (*Pennsylvania*)—President Sylvester has brought out some points that it would be well worth while to spend a little time in enlarging upon, even though we are not able to find anything to criticize.

He has brought forward the question of the "human element" as the cause of a large number of mine accidents. He has referred also to many occurrences that, if men had been present, would have resulted in an accident. Certain types of these occurrences have been classified as "near accidents," such as the falling of a cage in a shaft, or a runaway string of cars, in which there was no personal injury. It has occurred to me whether it would not be desirable, as I think it would, to endeavor to secure statistics on the percentage of certain kinds of accidents, in which there are no injuries; for instance, the number of falls that occur in a mine from day to day, and which cause no injuries. I believe that would be a better basis on which to classify the hazards of a mine than merely to classify those that actually cause injury or death, and I have no doubt but that companies could insure those risks.

We know that many mines speak for themselves—those that have bad roof and numerous falls, naturally have the larger percentage of injuries occurring in them. I would like to learn if any member here knows of its being the practice anywhere to keep a record of such occurrences when, if men had been present, injury or death would have resulted.

Mr. Dunlop, in his remarks, has repeated the statement of the president to the effect that the technical compliance with the law does not mean a safe mine. We all realize that this is true and that, were it not for the human element involved, in the form of state mine inspectors, safety inspectors, mining engineers and others whose

work supplements the requirements of the law, a great many of our mines would not be in as safe a condition as they are at present.

But I would like to ask, Is the mine inspector justified in going beyond the requirements of the law? Has he fulfilled his whole duty to the state when he has seen that all of the provisions of the law are complied with; or has he a moral duty requiring him to go beyond the technical requirements of the law in an endeavor to have things performed in a mine for safety that are not called for by the state law? Let me illustrate my meaning.

Many of our state laws say that the inspector, in addition to seeing that the details of the law are complied with, shall not permit any unsafe practices. Here we introduce the human element in the form of the judgment of the inspector. Some inspectors will regard a certain condition as safe that another inspector would say was unsafe. We know how the opinions of many mining men, miners and inspectors, have differed concerning the hazard of the presence of dust in a coal mine, and we have found what precautions or remedies are efficient in reducing the danger. One inspector, however, may consider one remedy efficient where another inspector will consider another remedy more efficient. In view of the controversy on a number of these points, as to what constitutes a dry and dusty mine, where dust is present in large quantities, and what constitutes a gaseous mine and what a nongaseous mine, where the state law does not specify the inspector necessarily must rely upon his own knowledge and judgment. His judgment may be that the mine is not dangerously dusty. And yet an explosion may occur in that mine in which dust is the principal factor in the propagation of the flame, and show that the inspector misjudged the conditions.

Now, I would like to have an expression from some of the experienced men here upon this particular point, as to whether or not the inspector is justified in going beyond the requirements of the law.

MR. BOYLE (*Oklahoma*)—I desire to say a word or two along the line of whether an inspector should go further than what the law provides. My judgment in

this matter is that the only construction that can be placed on a law creating the office of Inspector of Mines is that it expects the inspector to use his own judgment as to whether a mine is safe or dangerous when he enters that mine and makes the examination. In my judgment, if an inspector discovers something in that mine that the law has never taken into consideration or mentioned and which he decides is dangerous, it is his duty to the men employed there and he has a perfect right to order the necessary remedy and, if necessary, to withdraw the men until that condition is remedied. We do not have inspectors to make our laws, but their purpose is to go in and examine the mines and discover, if possible, whether or not they are in a safe or unsafe condition. If an inspector discovers that a mine is unsafe, in my opinion, he has a right to order a remedy and enforce it.

Every inspector dealing with coal operators meets with the same experiences as expressed by our president in his message today. He finds certain operators that are apparently using every precaution to protect the lives of their men and the company's property, while other operators will claim their mines are safe, though they are not complying with the law. The last-named operator does not, apparently, stop to consider whether danger exists in his mine. With him it is just a matter of whether he is complying with the exact letter of the law; and he overlooks the danger that the law has probably never reached or sought to reach. In my judgment, when the inspector goes into such a mine and finds those conditions he has a perfect right to order a remedy, and without he exercises that right he might as well give up his job, because he encounters just such things in most every mine he enters. I believe the order of an inspector has absolute effect at law, and I believe any reasonable court will so hold; if not, any average miner could see that the intention of the law was not being fulfilled.

In the State of Oklahoma we have laws providing for certain traveling ways to be 6 ft. wide and 5 ft. high, and if we wanted to stand on a technicality in that regard we could shut down practically every mine in the district. When it comes to a question of height and width it is a

matter for the parties working the mine to decide and use their common sense. In some instances it would be almost impossible to work a mine in the manner prescribed by law. For example, we have a mine where, if we had to widen the traveling ways as required by law, we would lose the pillars and take away the support of the roof. Our law does not provide for all dangers, nor does it provide the necessary remedies or give the inspector discretionary power; and many inspectors will not take any upon themselves, because the law does not give them the authority.

THE PRESIDENT—From the viewpoint of the operator, allow me to remark that my attention has been called once or twice to the fact that for an operator to conscientiously believe his mine to be absolutely safe is impossible. Of course, there is no operator who believes danger could not occur in a mine. An operator and I were commenting recently on the rules of mining, and he asked, "Don't you think my mine is safe?" I replied, "No"; and yet there was nothing in the law by which I could show any violation. I might inspect that mine every day and find conditions the same; and again I might not be around for a month or two, and a condition arise that would make the place highly dangerous, which no man can foresee. The point I had in mind is that the man who realizes his mine has an appending danger is a much safer man than one who believes his mine to be safe right through and makes no provision for possible dangerous conditions.

MR. NESBITT (*Alabama*)—The interpretation of mining law, in regard to the authority of an inspector, is the broadest subject that has been brought before this Institute. I have many times been confronted by situations in which I did not know what way to turn and had no law to back me up, and felt that the only thing to do was to offer some remedy in the way of a friendly suggestion. But, suppose an operator absolutely refuses to carry out an inspector's orders, knowing that he has gone beyond the limit of the law, the inspector is placed in a very embarrassing position. For that reason I have always tried to stick as close to the law as possible and

make outside suggestions that I deemed necessary, in a friendly way.

I do not believe there is a conscientious mine foreman or operator but who is in sympathy with humanity and who would be willing to accept suggestions from a friend or an inspector that would improve conditions in his mine. We never get too old to learn and it is the man who is willing to learn that does learn. The fellows who know it all, you can put down as being one lot of "impossibles."

Let me ask, Suppose you make certain requirements or attempt to compel an operator to do certain things beyond the letter of the law and you take it to court, would not that court be bound to uphold the operator in his rights under the law, which gives you no authority to compel him to carry out those instructions? I fully realize that our mining laws are not complete and do not cover all conditions.

Mr. Rutledge (*Oklahoma*)—I am not acquainted with the present Illinois mining law, but some years ago I heard the best lawyer in that state, where I was raised, say that the law was unconstitutional, but claimed that so long as it had never been questioned in court it was good law. I think Mr. Dunlop will bear me out in respect to some experiences inspectors have had in that state, in the strict application of the law getting them into trouble and resulting in litigation. I think a good mining law is essential for proper mine inspection. I do not recall now the exact reading of the West Virginia law, but have heard the clause debated a number of times by inspectors and lawyers. I think the clause reads: "Or any other dangerous practice." I do not believe we can make any hard and fast rules in coal mining.

I can better illustrate my point by narrating some things that recently occurred in medical science. We have had in the Southwest a number of epidemics lately—some eye diseases and some throat diseases, prevalent among children; also, measles, which may become complicated with other diseases and result fatally. Now, unless a physician is called, according to law they do not have to quarantine the house. The result is, that the children are permitted to run about and expose others,

these diseases being contagious. There is no quarantine put on other dangerous diseases, such as trachoma and some eye diseases. If an inspector were to act only as the law required many dangerous diseases would be spread, to avoid which the inspector must use his judgment. If a physician knew there was a dangerous condition in a house and went there and proffered his service, he would be compelled to put up a placard and quarantine the house. So when an inspector finds dangerous conditions that are not provided for in the mining law, it is his duty to recommend the abatement of those practices. I do not think, for my part, that we can confine ourselves absolutely to the letter of the law.

MR. BARTLETT (*Ontario*)—In the mining law of the province of Ontario, we have a clause that is, I believe, common to the laws in different parts of the British Empire, providing that when an inspector sees any unsafe practice or condition that affects the welfare or health of employees, he is empowered to take action to remedy the same. I understand that, in drafting a mining code recently, the United States Bureau of Mines, or Commissioners appointed by that bureau, took exception to this clause, which we have found very useful.

I fully agree with what has been said, that it is not possible, in a code of laws, to cover every condition that can arise in a mine. Certain discretionary powers must be allowed the inspector in administering the law. We are continually meeting with conditions that are not covered in our mining act. For instance, about a week ago, I visited a mine and found the law violated—not in one respect only but in several. One of our laws calls for the partitioning off of a manway compartment from the hoisting compartment. At a few places this has not been done. In one manway compartment a pump had been put down, as the shaft was very wet and it was difficult for a man to get down and keep a light burning. No one when drafting a law would think that a man would be so foolish as to stick a pump down a manway compartment. In that case the men had to cross over and climb down a ladder hung in the hoisting compartment. Of course, such a condition, not being covered by the law,

throws a great responsibility on the shoulders of the inspector, who must use his best judgment, and in doing that he is liable to get into trouble. I think such a clause as I have mentioned is necessary at times.

MR. FLYNN (*Alabama*)—Just a word on this question of mining law. There are two kinds of law that are well recognized by all the courts of this country. One is known as "statutory law" and the other is "common law." Statutory laws are, of course, the written laws, while common law is the unwritten law—the law based on practice and customs that have been handed down from generation to generation. Most of the common laws in our country were taken from the common laws of England even before the statutory laws were enacted.

Now, an inspector has a right to work under both of those laws. A mine operator may comply strictly with all the statutory laws governing the operation of coal mines and still an accident may occur in his mine, and, under the common law, he is liable for damages for that accident, because by that law every employer is compelled to furnish his employees a reasonably safe place to work. If he does not furnish such a place to work or is negligent and an employee is injured, then he is liable for damages, although the statutory laws do not cover the case. An inspector of mines has a right, in my opinion, to make any recommendation and suggestion that he deems is necessary for the safe operation of the mine and the protection of those engaged therein, regardless of whether the matter is covered by the law or not.

I remember an incident that occurred in Alabama, when I was chief mine inspector, and permissible powders were being introduced in the mines. I recall taking up the question of the use of permissibles. Previously we had been using a high-grade dynamite. In company with three inspectors I held a conference with the president, secretary, treasurer and general superintendent of a large coal company. The treasurer said that one of the reasons why he did not want permissibles used in the mine was, that it would reduce the earnings of the commissary. He stated that he could buy dynamite much cheaper than he could purchase permissible explosives. I said,

"That is probably true; the state department, however, is not interested in your commissary, but in the safety of your men, and if you put commissary earnings above the safety and welfare of your employees, you do not show much humanity in dealing with them." He replied, "You have no law to compel our company to use permissible explosives." I said, "That is true; but, while the law does not cover that matter should an accident occur in your mine from the use of high explosives, I want to go on record right now and inform you that the state department will hold your company responsible, if it can be shown it was caused by the use of such explosives. The president then turned to me and said, "Flynn, do you mean to say that if we have an accident or explosion in the mine that can be attributed to the use of these high explosives, you will hold our company responsible for it?" I said, "I mean just that." "Would you go into court," he asked, "and testify to that fact?" I replied that I would. He turned at once and gave an order to the superintendent to prohibit the use of dynamite in all their mines. This is an instance of the working of common law, where the statutory law did not reach.

I believe in and have followed the practice of making such suggestions as are necessary, whether or not they are covered by the statutes. When sending a letter with such recommendations I made it as forcible as possible, and always called attention to the fact that they were permitting unsafe conditions or practices in their mine that were liable to cause accidents and law suits for resultant damages, and that it would be cheaper and better to eliminate such danger.

Of course, some operators do all they are asked, without being forced. They view the prevention of accidents from the standpoint of humanity, and my observation and experience have proved that the prevention of accidents has been the financial gain of such companies. Statistics compiled by various companies prove that it is far cheaper to prevent accidents than to have them occur and fight damage suits. The operator who wants to do the fair thing will comply for the sake of humanity. But the operator who refuses to do anything that will affect his

production or decrease his earnings, must be compelled to do what is necessary, and the best way in the world to accomplish the task is to threaten his pocket-book, for that is his god.

Mr. Paul—I believe it is proper and necessary for an inspector to use his judgment in having safe practices used in a mine whether the law provides for it or not; but I know of some experiences that inspectors have had in going beyond the letter of the law, and making suggestions and later attempting to enforce those suggestions, which were along safety lines. The matter was carried to the extent of closing the mines and the case being taken into court; the judge ruled that the inspector had performed his whole duty when he had seen that the statutory law had been complied with. He held that the statutory law created the office of mine inspector for the purpose of seeing that the statutory law was obeyed, and that in going further the inspector exceeded his authority as an executive officer and assumed to become a legislative officer, which was incompatible with the constitution of the state.

While that and other similar ones were exceptional cases, I have known many operators and miners to accept the suggestions made by the inspector for their mutual good and protection. But when it comes to a question of law and equity the courts have ruled in several instances that the inspector has no legislative authority—merely that of an executive. Oftentimes inspectors by their force of personality and character are able to accomplish many things, as Mr. Flynn has just shown.

The President—The incident Mr. Flynn has cited calls to my mind a somewhat similar occurrence in my own experience. It frequently happens that mine operators want an inspector to assume all the responsibility. In the instance I am about to mention it was a question of black powder being used in a mine. The operator said to me, "My mine is perfectly safe and while I am using permissibles at present, I want to go back to black powder." I replied, "There is no law in this state that will compel you to use either black powder or permissibles. If you see fit to go back to black powder there is no way

in which I can stop you; but I want to put myself on record as chief mine inspector of this state that I consider the use of permissibles as necessary for the safety of your mine. If you go back to black powder you will do so with that statement on record in my office. He answered, "No, we want you to allow us to do it." I said, "I shall not take any such responsibility." The result was they did not go back to black powder and are still using permissibles.

Mr. Graham (*British Columbia*)—I think it will be generally conceded that there is no law that can be constructed that will cover fully the possibilities that may arise within our province of British Columbia. In view of this fact, it appears to me that there must of necessity be a certain amount of discretion accorded the men who administer these laws. I can readily see, from what our secretary has said, that in a country that has a constitutional form of government there are possibilities of conflicting with the constitution, when the case is carried into the courts. In our province we are placed in a different position in respect to the law. When our legislators create a law granting an inspector discretionary powers to prohibit any practice in a mine that he considers dangerous to the lives of the employees, then that is the law. There is, however, the possibility, as one of the speakers has stated, that a man may overstep his judgment.

Under the British Coal Mines Regulation Act, an operator has a right to appeal to arbitration, and a board of competent mining men will then be appointed to consider the case; but, in the meantime, the request of the inspector must be complied with, pending the decision of the board of arbitration.

I think, as I have stated, it is impossible to create a law which would cover fully all these particular phases that might arise in a coal mine; and unless discretionary powers are given to an inspector he will be practically helpless. I might state an instance in this particular case. In our Coal Mines Regulation Act there is no restriction whatever in regard to the use of gasoline pumps, motors or anything of that kind. Several times

this question has arisen as to the installation of gasoline pumps and motors in our mines. I have written to the minister of mines, stating that no gasoline-propelled pump or motor should be used in a mine in British Columbia. Some day some operator may call for arbitration on that question. However, the decision I rendered is being carried out at the present time.

The secretary then announced the following subjects for informal discussion, and was authorized to embody the same in the program for the coming sessions:

1. The Use of Explosives in Oklahoma Mines; discussion to be opened by Frank Haley, inspector of mines, Henryetta, Okla.

2. Ventilation at Time of Shooting in Iowa Mines; discussion to be opened by W. E. Holland, state mine inspector, Albia, Ia.

3. Use of Permissible Explosives in Alabama Mines; discussion to be opened by C. H. Nesbitt, chief mine inspector, Birmingham, Ala.

4. Stripping Operations in Kansas; discussion to be opened by P. J. McBride, commissioner of labor, Topeka, Kan.

5. The Success of the Compensation Laws of Pennsylvania, in their Application to Mining; discussion to be opened by David J. Roderick, state mine inspector, Hazleton, Penn.

6. The Selection of Mine Foremen in Pennsylvania Under the Law Eliminating the Necessity of Certificates; discussion to be opened by P. J. Moore, state mine inspector, Carbondale, Penn.

7. Safety First as it Applies to Mining in the Province of Ontario, Canada; discussion to be opened by James Bartlett, inspector of mines, Haileybury, Ont.

8. Safety in Underground Haulage; discussion to be opened by Thomas P. Back, Canton, Ill.

9. The Coal Mines of Missouri; discussion to be opened by George Hill, chief inspector of mines, Bevier, Mo.

10. The Zinc Mines of Southwestern Missouri; discussion to be opened by C. M. Harlan, state mine inspector, Carterville, Mo.

11. Cardinal Points in Testing Miners' Safety Lamps; discussion to be opened by Prof. J. T. Beard, senior associate editor, *Coal Age,* New York City.

12. What Constitutes Efficiency in Mine Inspection; discussion to be opened by Dr. J. J. Rutledge, mining engineer, U. S. Bureau of Mines, McAlester, Okla.

By motion, regularly seconded and carried, the secretary was instructed to draw up a suitable division of these subjects in order to get them better before the Institute.

The president then announced the following appointments:

Committee on Resolutions—Rutledge (Oklahoma), Graham (British Columbia), Beard (New York).

Committee on Auditing—Nesbitt (Alabama), Dunlop (Illinois), Harlan (Missouri).

Mr. Graham (*British Columbia*)—Mr. President, in view of the fact that there are a few gentlemen expected here, who have not yet arrived, I suggest that we might well adjourn this afternoon, to meet tomorrow morning at 9:30 o'clock, when these gentlemen will possibly have arrived. With three days then at our disposal, I think we will have ample time to cover the subjects and papers that will come before the convention. I make this a motion.

The motion being duly seconded was unanimously adopted and the Institute adjourned until Wednesday morning, June 14, at 9:30 o'clock.

Wednesday Morning, June 14, 1916

The meeting was called to order by the president promptly at 9:30 a.m. and the Committee on Membership reported as follows:

Report of Committee on Membership

Mr. Hill (*Missouri*)—The Committee on Membership report and recommend that the following named persons be elected members of this Institute:

Illinois:
Ben D. Roberts, State Mine Inspector.
John Bohlander, Pres. State Mining Board.

Kansas:
John Pellegrino, Ass't. Commissioner of Labor.

GEORGE HILL, Chairman,
EDWARD FLYNN,
THOMAS P. BACK.

The report of the Committee on Membership was adopted by unanimous vote and the candidates received at once into full membership in the Institute.

The president then asked for the report of the treasurer, which on being presented was referred to the Auditing Committee. (See Report, page 11.)

At the invitation of the president, Thomas Graham, chief mine inspector of the Province of British Columbia, read an interesting paper, which he had prepared for presentation to the Institute.

MR. GRAHAM'S PAPER

SOME GASEOUS MINES IN THE CROW'S NEST PASS COAL FIELD, BRITISH COLUMBIA

The Crow's Nest Pass coal field is situated in the Southeastern portion of the Province of British Columbia. The coal field lies immediately to the west of the summit of the Rocky Mountains. In shape, the basin is described by James McEvoy, mining geologist, as "A long-pointed triangle, with its base to the south, the area containing coal being approximately 230 sq.mi. Its greatest length is about 35 mi. north and south and its greatest width about 13 miles.

The coal seams are in the Cretaceous measures, and a section of these, measured by Mr. McEvoy, at Morrisey, near the southern end of the field, shows a thickness of nearly 5,000 ft. and contains 200 ft. of coal. This coal occurs in about 2,000 ft. of the measures and, making allowance for impure coal and seams less than three feet

in thickness, it is estimated that the workable coal in the field is 100 feet.

The field is reached by two railways, the Crow's Nest Pass branch of the Canadian Pacific Ry. enters the field from the east through the Crow's Nest Pass, follows down Michel Creek and crosses the northern part of the coal area, and then follows the valley of the Elk River, along the western side of the coal area for nearly 25 mi. The Great Northern Ry. enters the field by a branch which leaves the main line at Rexford, Mont., and reaches the southern end of the field near Morrisey, parallels the Canadian Pacific Ry. in the Elk Valley through Fernie, Hosmer, Olsen and Sparwood, and thence up Michel Creek to Michel. The upturned western edge of the coal-bearing series forms a ridge paralleling the Elk River and a few miles distant from it. The height of the ridge being about 3,500 or 4,000 ft. above the river, the coal seams outcrop about half way up this ridge and pitch eastward.

The field was first opened, in 1897, at Coal Creek, a tributary of the Elk River, about 5 mi. east of Fernie, which is now the principal city in the field and, since that time, openings have been made at Morrisey, Michel, Hosmer and Corbin.

The principal operations are at present conducted by the Crow's Nest Pass Coal Co., Ltd., at Coal Creek and Michel, about 20 mi. northeast of Fernie. The Corbin Coal and Coke Co. are operating on a small detached portion of the field on the east side of the basin about 17 mi. due east of Fernie and about 40 mi. distant by rail.

Morrisey Colliery

This colliery is near the southern end of the field. Operations were commenced in 1901 but, owing to inability to cope with the outbursts of gas, were finally abandoned in 1909. In the No. 1 mine an outburst occurred Aug. 6, 1903. The seam is irregular, varying from 14 to 40 ft. in thickness, with a strong roof and floor. Three openings had been made on the seam, two being intakes and one a return. The levels had been driven about 2,000 ft. and were carried in the upper 10 ft. of the seam.

About 60,000 cu.ft. of air per min. was in circulation in the mine, at the time, the water gage being about ¾ of an inch.

This outburst occurred in a crosscut between the center and the upper level. The men had warning of the movement, but the outburst occurred before they reached the outside of the mine. The escaping gases reversed the ventilation and fine coal and dust was blown out of the mine mouth. Four days elapsed before the mine could be reëntered. An examination showed that much fine coal had been blown into the main level and 1,456 tons of "fines" were removed before the original face was reached. Here a cavity was found 8x10x110 ft., extending beyond the original line of face.

Another outburst occurred Oct. 14, 1904, in which four men were smothered in the fine coal discharged; but this outburst was less violent than the one in August of the preceding year, less gas being given off and only about 800 tons of coal displaced.

Still another large outburst of gas occurred Nov. 18, 1904, in which 14 men were smothered. A huge cloud of coal dust shot out of the mine mouth. This was so fine that it was described by eyewitnesses as smoke. The outburst occurred at the face of the center one of the three main levels. For half an hour after the outburst occurred all three openings were emitting gas in such quantities that they could not be approached. The volume of air in circulation was 57,000 cu.ft. per min. The fan never stopped and the self-recording water gage showed no change in pressure. The displacement of coal in this outburst was estimated by the management as 3,500 tons. The volume of gas given off in the first 30 min. after the outburst was estimated by various authorities, at from 2,000,000 to 5,000,000 cubic feet.

The colliery was then closed down for a few years, but in 1907 work was resumed, and several openings made on other seams. But, again, an outburst occurred, Jan. 27, 1909, at the face of the main level in No. 7 mine. This filled the level with coal for a distance of 15 ft. and 15 min. later gas was issuing from the mouth of the mine in such quantities that the flame of a safety lamp was

extinguished in the free atmosphere, 30 ft. outside the entrance of the tunnel.

This occurrence was followed, May 5, the same year, by a smaller outburst at the face of the main tunnel in No. 7 mine, which caused the death of two men, who were suffocated by the fine coal displaced. In this instance, the gas only filled the level for a distance of a few hundred feet. Two weeks later, May 19, another outburst took place only 14 ft. in advance of the place of the previous one, but fortunately no lives were lost; although the displaced coal left a cavity about 8 ft. in diameter and 25 ft. in depth, and gas issued from the mine mouth for a period of 6 hr. after the outburst. The colliery was then abandoned and no attempt has since been made to reopen it.

The term "bumps" is a somewhat local expression used to describe the ominous sounds that betoken the movements of the strata overlying the several seams operated in the Crow's Nest Pass coal field. These "bumps," although usually accompanied by more or less heavy discharges of gas, are not in the nature of the outbursts of gas and coal I have just described. The Coal Creek colliery has been the seat of most of the "bumps," which are sufficiently severe to shake the houses in the village and, at times, cars and other movable materials are displaced in the mine. The colliery is situated in the narrow valley through which the waters of Coal Creek run. This valley is about 1,000 ft. in width, the mountains on each side rising to a height of about 2,500 ft. above the level of the creek, at the mine.

The superincumbent strata overlying the present operations on the south side of the creek do not exceed 1,400 ft. vertical elevation; but as the measures have been cut through the creek valley, in many instances by lateral gulches at right angles to the valley, the overlying strata are frequently exposed on several sides, thus throwing an enormous thrust upon the supporting pillars in the mine. A large proportion of the "bumps" have occurred in the area worked by No. 2 mine, lying on the south side of the creek. This mine was one of the first opened in the field and the mode of working was very irregular.

The "bumps" are usually accompanied by an upheaval of the floor in the vicinity. In many instances, for several hundred feet in a roadway averaging 6 ft. in height, the floor would be thrown almost against the roof by the gas given off from the soft shale floor and by the pressure brought on the surrounding pillars. The "bumps" were most severe in 1907 and 1908, when it became necessary to restrict operations in certain areas in the mine. New openings are now being made to win the coal from the territory lying beyond the restricted area in No. 2 seam. The mode of operation will be by pillar and stall, similar to the operations that have been conducted over this restricted area, in an overlying seam 100 ft. above No. 2, which has been opened by a mine known as No. 1 East a photo-plan of which accompanies this paper.

Since operations were conducted along these lines the "bumps" have been fewer in number, and are confined largely to the area covered by the old workings in No. 2 mine. Recently, while accompanied by considerable earth tremor, they have not caused any damage or large effusions of gas in the No. 1 East mine. My object here is not to deal with sudden outbursts of gas or "bumps," but rather with the general emanations of methane from the seams of this particular field, though it seemed essential to refer to these now well-known occurrences.

Several attempts have been made at both the Coal Creek and Michel collieries to operate some of the smaller seams, on the longwall basis, but for some reason or another this mode of working has always been abandoned, which is unfortunate, as several of the seams are well suited to longwall operations. The longwall method would provide easier and more perfect ventilation in seams giving off gas as freely as is the case in these collieries. However, the present method of operation is all on the pillar-and-stall method, as shown in the accompanying plan (Figs. 3 and 4).

Early in 1915 the Department of Mines of the Dominion Government at Ottawa undertook the work of analyzing samples of mine air taken from the mines in the various Provinces of Canada. The mode of collecting these samples of air is by means of vacuum bottles, from

which the air had been previously exhausted. These bottles were provided with a long slender neck, which was tightly sealed when the air had been exhausted. The seal was broken by a file cut as shown in Fig. 1, at the point where the sample was taken. The neck of the bottle was then sealed with wax as shown in the figure.

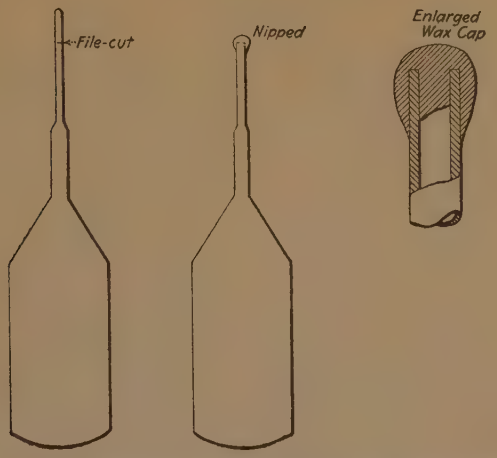

FIG. 1. DIAGRAM SHOWING VACUUM BOTTLES USED TO COLLECT SAMPLES OF MINE AIR

The Federal Mines Department furnished the bottles and made the analyses free of any charge to the Provinces. Advantage of this offer was taken by the Mines Department of the Province of British Columbia, in the hope of obtaining valuable data on the emanations of methane from the Michel and Coal Creek mines, which had long been known to be of a very gaseous nature.

Michel Colliery

This colliery is situated about the center of the trough or basin, near the northern end of the coal field. Seven seams have been operated at this colliery—No. 9, 10 ft.; No. 8, 12 ft.; No. 7, 11 ft.; No. 5, 7 ft.; No. 4, 7 ft.; No. 3, 5 ft., and the new No. 3 seam, 11 ft. in thickness.

Only three of these seams are being worked at the present time; namely, No. 8 seam, on the north side; No.

3 and No. 3 East, on the south side. The coals are bituminous in character and make an excellent coke, without washing, in ovens of the beehive type.

Tables Nos. 1, 2 and 3 show the results of analyzing a series of mine-air samples taken in the three mines now being operated in the Michel colliery.

TABLE 1. MICHEL COLLIERY

No. 8 Mine

Sample No.	Date	Where Taken on Return	Average Daily Production in Tons	No. of Men in Mine per 24 Hr.	Volume of Air in Circulation (Cu.Ft. p. Min.)	Per Cent. of Methane in Air	Volume of Methane	
							Cu.Ft. per Min.	Cu.Ft. per Ton of Coal Mined
22	Oct. 28, '15	East-Side	300	...	12,000	0.13	15	75
23	Oct. 28, '15	West-Side	180	...	13,000	0.10	13	104
24	Oct. 28, '15	Main Return	500	110	43,000	0.07	30	86

TABLE 2. MICHEL COLLIERY

No. 3 East Mine

6	July 5, '15	West-Side Split	120	...	14,400	2.90	417	5,004
8*	Aug. 4, '15	West-Side Split	...	...	18,500	1.33	246	2,952
9	Aug. 3, '15	West-Side Split	120	...	18,500	3.33	616	7,392
10	Aug. 3, '15	Main Return	500	140	102,600	1.48	1,518	4,371
16	Aug. 18, '15	No. 6 East Split	100	...	13,050	0.64	83	1,195
17	Aug. 18, '15	East-Side Split	120	...	5,500	1.57	86	1,032
18	Aug 18, '15	West-Side Split	130	...	12,000	2.32	278	3,079
20	Aug. 18, '15	No. 8 West Split	160	...	21,000	1.59	333	2,997
21	Aug. 18, '15	Main Return	500	140	96,000	1.15	1,104	3,179
26	Jan. 7, '16	West-Side Split	180	...	23,400	1.46	341	2,728
28	Jan. 7, '16	No. 8 West Split	130	...	24,750	0.83	205	2,270
44†	Feb. 17, '16	No. 6 East Split	120	...	19,800	1.24	245	2,940
45†	Feb 17, '16	East-Side Split	120	...	17,000	1.17	198	2,376
29	Jan. 7, '16	Main Return	550	150	120,000	1.27	1,524	3,990
34*	Jan. 12, '16	No. 6 East Split	...	...	18,000	1.08	194	2,328
35*	Jan. 12, '16	West-Side Split	...	...	19,305	1.19	229	1,832
36*	Jan. 12, '16	East-Side Split	...	...	16,000	0.96	153	1,836
37*	Jan 12, '16	No. 8 West Split	...	...	16,500	1.28	211	2,337
38*	Jan. 12, '16	Main Return	...	...	120,000	1.22	1,464	3,833

TABLE 3. MICHEL COLLIERY

Old No. 3 Mine

1	Mar. 3, '15	East-Side	90	...	36,900	2.66	981	15,695
3	Apr. 13, '15	Main Return	450	150	96,000	1.64	1,574	5,036
5	June 16, '15	West-Side	220	...	42,000	1.49	625	4,090
7	July 8, '15	No. 3 Slope	200	...	7,500	3.83	287	2,066
11	Aug. 6, '15	No. 3 Slope	40	...	9,600	2.79	267	9,612
13	Aug. 17, '15	West-Side	125	...	26,100	1.74	454	5,230
14	Aug. 17, '15	East-Side	60	...	30,800	2.09	643	15,432
15	Aug. 17, '15	Main Return	230	125	80,000	1.76	1,408	8,815
30	Jan. 7, '16	West-Side	65	...	4,000	0.07	2.8	62
31	Jan. 7, '16	No. 3 Slope	150	...	4,500	2.41	108	1,036
32	Jan. 7, '16	East-Side	160	...	31,680	2.30	726	6,534
43†	Feb. 16, '16	Main Return	375	150	80,000	1.76	1,408	5,407
39*	Jan. 12, '16	West-Side	...	...	3,640	2.04	73	1,617
40*	Jan. 12, '16	No. 3 Slope	...	...	5,200	2.09	108	1,036
41*	Jan. 12, '16	East-Side	...	...	25,200	2.18	549	2,108
42*	Jan. 12, '16	Main Return	...	...	60,000	1.83	1,098	4,216

* Samples taken when mine was not working.

† Sample taken to replace sample lost en route to laboratory from series of Jan. 7, 1916.

No. 3 East Mine

This mine has four ventilating splits. The daily output of coal is approximately 550 tons. Coal is produced in two shifts of 8 hr. each, or 16 hr. of the 24-hr. day.

TABLE 4. ANALYSES OF MICHEL MINE-AIR SAMPLES

(Edgar Stansfield, Analyst)

Sample No.	Chemical Analysis						Technical Analysis		
	CO_2	O	CH_4	CO	H	N	Air	Fire-damp	Black-damp
No. 8 Mine									
22	0.08	20.77	0.13	....	....	79.02	99.24	0.13	0.63
23	0.07	20.80	0.10	....	....	79.03	99.38	0.10	0.52
24	0.07	20.78	0.07	....	....	79.08	99.28	0.07	0.65
No. 3 East Mine									
6	0.13	20.29	2.90	....	....	76.68	96.94	2.90	0.16
8	0.08	20.52	1.33	....	....	78.07	98.04	1.33	0.63
9	0.16	20.12	3.33	....	....	76.39	96.13	3.33	0.54
10	0.10	20.50	1.48	....	....	77.92	97.94	1.48	0.58
16	0.09	20.65	0.64	....	....	78.62	98.66	0.64	0.70
17	0.09	20.51	1.57	....	....	77.83	97.99	1.57	0.44
18	0.13	20.29	2.32	....	....	77.26	96.94	2.32	0.74
21	0.14	20.13	1.15	....	....	78.58	96.18	1.15	2.67
20	0.08	20.51	1.59	....	....	77.82	97.99	1.59	0.42
26	0.09	20.53	1.46	....	....	77.92	98.09	1.46	0.45
28	0.05	20.71	0.83	....	....	78.41	98.95	0.83	0.22
29	0.10	20.47	1.27	....	....	78.16	97.80	1.27	0.93
34	0.07	20.55	1.08	....	....	78.30	98.18	1.08	0.74
35	0.08	20.55	1.19	....	....	78.18	98.18	1.19	0.63
36	0.06	20.57	0.96	....	....	78.41	98.28	0.96	0.76
37	0.06	20.53	1.28	....	....	78.13	98.09	1.28	0.63
38	0.10	20.43	1.22	....	....	78.25	97.61	1.22	1.17
44	0.06	20.54	1.24	....	....	78.16	98.14	1.24	0.62
45	0.07	20.63	1.17	....	....	78.13	98.57	1.17	0.26
Old No. 3 Mine									
1	0.13	20.22	2.66	....	....	76.99	96.61	2.66	0.73
3	0.14	20.44	1.64	....	....	77.78	97.66	1.64	0.70
5	0.19	20.26	1.49	....	....	78.06	96.56	1.49	1.95
7	0.09	19.94	3.83	....	....	76.14	95.27	3.83	0.90
11	0.07	20.25	2.79	....	....	76.89	96.75	2.79	0.46
13	0.19	20.32	1.74	....	....	77.75	97.09	1.74	1.17
14	0.14	20.22	2.09	....	....	77.55	96.61	2.09	1.30
15	0.19	20.24	1.76	....	....	77.81	96.70	1.76	1.54
30	0.08	20.79	0.07	....	....	79.06	99.33	0.07	0.60
31	0.12	20.23	2.41	....	....	77.24	96.66	2.41	0.93
32	0.18	20.18	2.30	....	....	77.34	96.42	2.30	1.28
39	0.16	20.16	2.04	....	....	77.64	96.32	2.04	1.64
40	0.10	20.30	2.09	....	....	77.51	96.99	2.09	0.92
41	0.15	20.19	2.18	....	....	77.48	96.46	2.18	1.36
42	0.16	20.21	1.83	....	....	77.80	96.56	1.83	1.61
43	0.18	20.29	1.76	....	....	77.77	96.94	1.76	1.30

Note—The "technical analysis" has been calculated from the chemical analysis by taking air as having the following composition: Oxygen, 20.93 per cent.; nitrogen, 79.04 per cent.; carbon dioxide, 0.04 per cent. All the excess inflammable gases are then reported as "firedamp" and the excess extinctive gases as "blackdamp."

There are about 70 men in the mine on the two producing shifts. Samples Nos. 6, 8 and 9 are all from the west-side split and are interesting inasmuch as Nos. 6 and 9, showing 2.90 and 3.33 per cent. of methane, respectively, were taken when the mine was working; while No. 8,

showing 1.33 per cent. of methane, was taken when the mine was idle. This would indicate that the flow of gas was greater while the coal was being broken down.

Sample No. 10 was taken on the main return, at a point 350 ft. from the fan, and shows 1.48 per cent. of methane, or a volume of 1,518 cu.ft. of gas generated per minute, or 2,185,920 cu.ft. per day, which is equivalent to 4,371 cu.ft. of methane given off per ton of coal mined. Samples 16, 17, 18, 20 and 21 were all taken on the same day, Aug. 18, 1915, from four separate splits and the main return, while the mine was working. Samples 26, 28, 44, 45 and 29 were taken in January and February when the mine was working.

To show the effect on the generation of gas by reason of the mine being idle, samples 34, 35, 36, 37 and 38 were taken at the same points in the mine, Jan. 12, 1916, when the mine was not working. The results show little difference between the working day and days of idleness. It must, however, in justice be stated that not more than 15 hr. had elapsed between the cessation of work and the taking of the idle-day samples.

Old No. 3 Mine

This mine has three ventilating splits; the output in two working shifts of 8 hr. each averages 375 tons per day. Table No. 3 shows a series of samples from each split and from the main return, taken at different periods throughout the year 1915 and the early part of 1916. Samples 39, 40, 41 and 42 were taken on an idle day, and show slight difference in the emanation of gas on working or idle days.

Special attention is called to Sample No. 30. The analysis of this sample shows a methane percentage much less than that of any other sample taken in this mine. The chemist makes no mention of having observed a leak in the container at the time of making the analysis. But the fact that George O'Brien, inspector of mines for the district, reported that a Wolf safety lamp showed a slight cap of gas in the atmosphere at the time the sample was taken; and, further, Sample No. 39, taken five days later when the mine was idle, shows 2.04 per cent. of methane, would seem to indicate that a leakage had

occurred in the container during transit. Sample No. 1, taken Mar. 3, and Sample No. 14, taken Aug. 17 the same year, 1915, on the east split, show respectively 15,695 and 15,432 cu.ft. of methane per ton of coal mined.

The volume of gas given off in this mine, while always large, seems to be materially increased at points where the coal has been subjected to pressure and crushed; this is especially noticeable near the breaks shown in the cross-section of strata, in this portion of the field. Blowers of more or less intensity are often encountered here and, despite the fact that the ventilating current in many cases equals 1,000 cu.ft. per min. per man on the split, and that a limited number of men, rarely reaching and never exceeding 20, are breaking down coal on any given shift, it is often necessary to reduce the number of men in the split for several days or a week, in order to prevent the atmosphere in the split becoming charged to the danger point.

The average daily volume of methane, in cubic feet per ton of coal mined, in each mine, is as follows:

VOLUME OF METHANE PER TON OF COAL MINED

Mine	No. of Samples	Aggregate, Cu.Ft.	Average, Cu.Ft.
No. 8	3	265	87
No. 3 East	19	57,671	3,035
Old No. 3	16	87,992	5,500
General average	38	145,928	3,840

The average volume of methane per ton of coal mined shown from nine samples from the main returns of these mines equals 4,326 cubic feet.

Table No. 4 shows both the chemical and the technical analyses of the samples taken in the colliery.

The following analyses of coal taken from Seams Nos. 3 and 8 are typical of the Michel colliery:

No. of Seam	Moisture	Volatile Combustible Matter	Fixed Carbon	Ash
3	1.01	20.95	71.00	7.04
8	1.50	22.10	68.50	7.90

The coals are very friable and the use of explosives in getting the coal is limited. The field is gaseous and safety lamps only are used, the Wolf lamp being the one in general use.

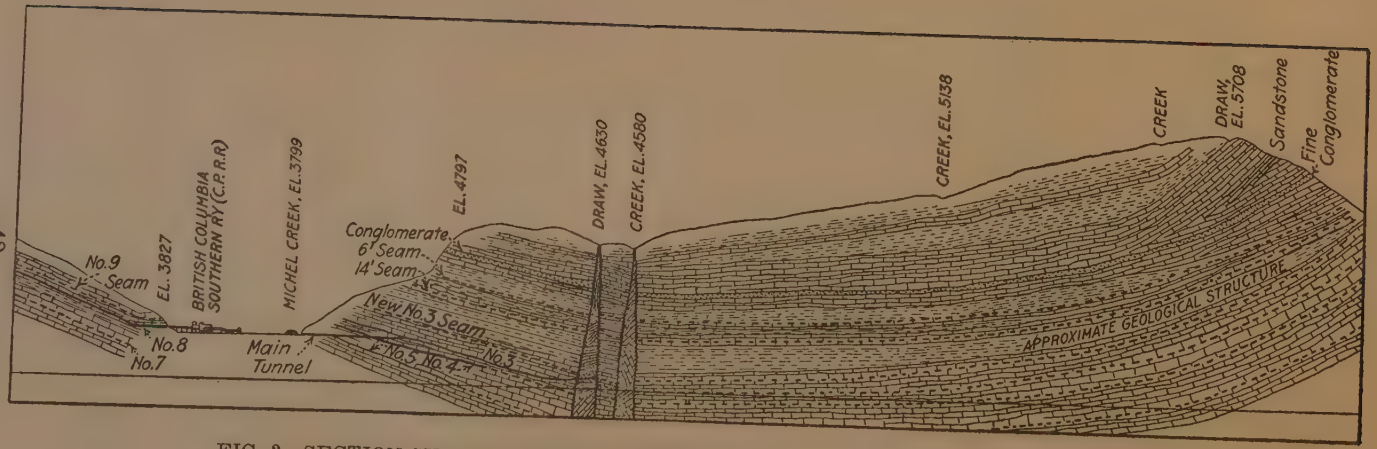

FIG. 2. SECTION SHOWING ARRANGEMENT OF COAL MEASURES AT MICHEL, B. C.

Scale—530 ft. = 1 in.

A reference to the section of the field at this colliery (Fig. 2) will show that the No. 8 seam, on the north side of the valley, is pitching with the slope of the mountain, the cover being comparatively light, approximately 300 ft. thick, which doubtless accounts for the small quantity of gas given off by this seam. Seams No. 3 and No. 3 East, on the south side of the valley, dip into the mountain and attain a cover of approximately 1,200 ft. in thickness, as appears in the cross-section shown in Fig. 1.

Coal Creek Colliery

This colliery is opened at a point on Coal Creek where the coal seams in their eastward pitch reach the level of the creek, the strike of the seams being approximately at right angles to the valley. The openings consist of drifts in the seams, starting on each side of the valley. Three seams are being worked at this colliery; namely, No. 1, No. 2, and the "B" seams. No. 1 is a large seam varying in thickness from 14 to 30 ft., only 10 ft. of this seam, however, is being extracted. No. 2 seam is 4½ to 5 ft. thick, while the "B" seam is 10 ft. thick, the upper 5 ft. only being worked. The coals are bituminous in character and make an excellent coke, without washing, in ovens of the beehive type. About 40 per cent. of the output of the colliery goes to the ovens.

No. 1 East Mine

This mine, shown in Fig. 3, has three splits and is producing 1,500 tons of coal per day of two working shifts of 8 hr. each. The samples given in Table No. 5 consist of one from each air split and the main return, taken when the mine was idle, and a similar set taken when the mine was working. Unfortunately three out of these eight samples were lost in transit and had to be retaken at a later date when conditions were not quite similar so far as the volume of air in circulation is concerned. The amount of methane, per ton of coal mined, as shown opposite Samples Nos. 25, 27, 49 and 50, is based, however, on the average tonnage produced when the mine was working.

FIG. 3. PLAN OF NO. 1 EAST MINE, COAL CREEK COLLIERY, CROWS NEST PASS COAL CO.

Sample No. 48, taken in the main return, shows this mine as giving off 4,184,640 cu.ft. of methane per day. The average volume of gas given off, per ton of coal mined, based on the eight samples in Table No. 5, is 1,556 cu.ft., while the average based on the two main-return samples is 2,291 cu.ft. per ton of coal mined.

The workings of this mine are those referred to early in the paper as overlying that area of No. 2 mine where the "bumps" are most severe, and which necessitated the abandonment of the area in question.

TABLE 5. NO. 1 EAST MINE

Sample No.	Date	Where Taken on Return	Average Daily Production in Tons	No. of Men in Mine per 24 Hr.	Volume of Air in Circulation (Cu.Ft. per Min.)	Per Cent. of Methane in Air	Volume of Methane	
							Cu.Ft. per Minute	Cu.Ft. per Ton of Coal Mined
25*	Feb. 23, '16	East-Side of Tunnel	....	...	15,400	1.87	288	1,036
49*†	Apr. 14, '16	Diagonal Split	....	...	33,000	1.67	551	1,983
50*†	Apr. 14, '16	West-Side of Tunnel	....	...	21,000	2.04	428	880
27*	Feb. 23, '16	Main Return	....	...	152,000	1.23	1,869	1,794
40	Feb. 24, '16	East-Side of Tunnel	400	...	12,000	2.73	327	1,177
39	Feb. 24, '16	Diagonal Split	400	...	30,800	1.49	459	1,652
41	Feb. 24, '16	West-Side of Tunnel	700	...	20,000	2.97	594	1,222
48†	Apr. 14, '16	Main Return	1,500	330	168,000	1.73	2,906	2,789

* Samples taken when mine was idle.

† Samples taken to replace samples lost en route to laboratory from series of February 23 and 24, 1916.

No. 3 Mine

This mine (Fig. 4) is opening out the coal lying beyond the restricted area just mentioned, in No. 2 mine, and working the same seam as that mine. No. 3 mine has three ventilating splits and produces 250 tons per day, in two shifts of 8 hr. each. Samples 17 and 22 were taken in the main return. Samples 28, 29, 30 and 31 were all taken from each split and the main return on the same day and when the mine was idle. Samples 34, 35 and 36 were taken from the same splits on the following day when the mine was working. Sample No. 47 was taken in the main return on a working day nearly two months later, to replace a sample lost in transit from the series taken Feb. 24, 1916. The volume of gas given off, per ton of coal mined, based on the 10 samples of Table No. 6, averages 3,740 cu.ft.

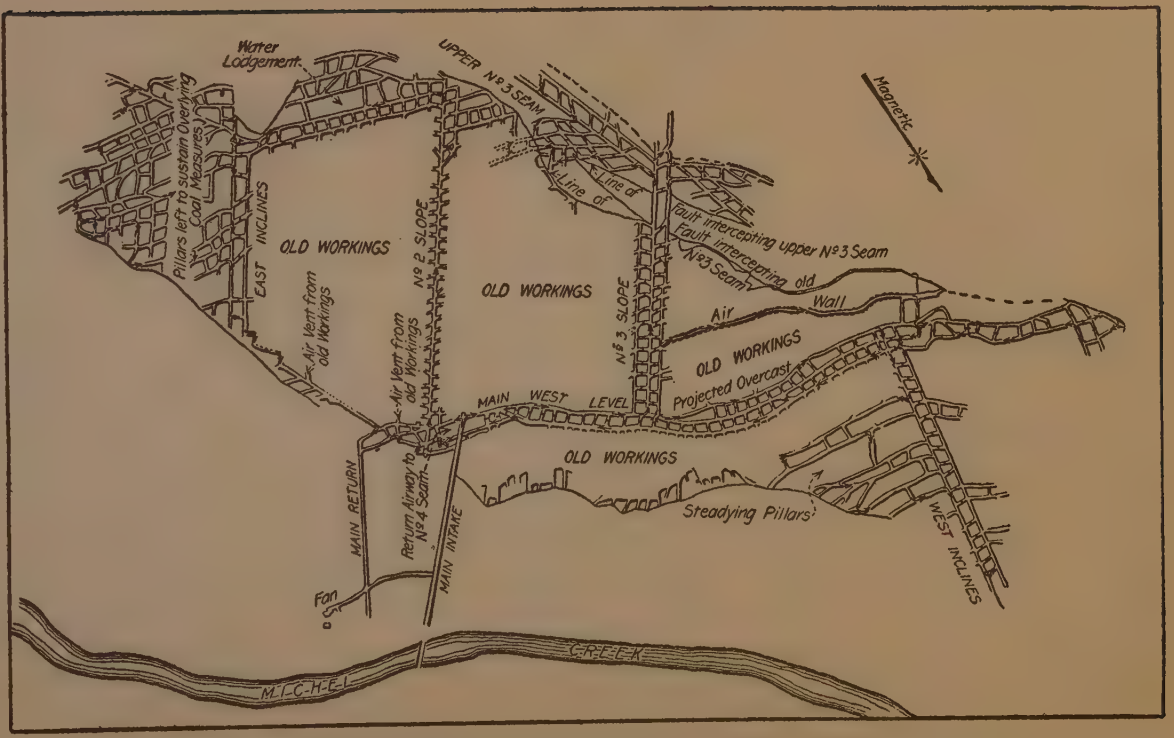

FIG. 4. PLAN OF NO. 3 MINE, MICHEL COLLIERY, CROWS NEST PASS COAL CO.

The coals are friable and little of any explosives are used in mining the coal. The seams are gaseous and safety lamps only are used, the Wolf lamp being generally employed.

TABLE 6. NO. 3 MINE

Sample No.	Date	Where Taken on Return	Average Daily Production in Tons	No. of Men in Mine per 24 Hr.	Volume of Air in Circulation (Cu.Ft. per Min.)	Per Cent. of Methane in Air	Volume of Methane	
							Cu.Ft. per Minute	Cu.Ft. per Ton of Coal Mined
17	Nov. 18, '15	Main Return	250	80	38,500	2.46	947	5,454
22	Dec. 30, '15	Main Return	250	80	37,500	1.03	386	2,223
31*	Feb. 23, '16	South Level	175	..	10,000	2.29	229	1,884
30*	Feb. 23, '16	Right-Side of Slope	40	..	6,000	1.10	66	2,376
28*	Feb. 23, '16	Left-Side of Slope	35	..	9,000	1.83	164	6,747
29*	Feb. 23, '16	Main Return	250	80	37,800	1.01	381	2,194
34	Feb. 24, '16	South Level	175	..	10,000	2.05	205	1,686
35	Feb. 24, '16	Right-Side of Slope	40	..	6,000	1.15	69	2,484
36	Feb. 24, '16	Left-Side of Slope	35	..	9,000	2.26	203	8,352
47†	Apr. 14, '16	Main Return	250	80	40,500	1.89	765	4,006

* Samples taken when the mine was idle.

† Sample taken to replace sample lost en route to laboratory from series of February 24, 1916.

Tables Nos. 5 and 6 show the conditions attending the taking of mine-air samples from the mines now being operated at this colliery.

TABLE 7. COAL CREEK COLLIERY

Sample No.	Date	Where Taken on Return	Average Daily Production in Tons	No. of Men in Mine per 24 Hr.	Volume of Air in Circulation (Cu.Ft. per Min.)	Per Cent. of Methane in Air	Volume of Methane	
							Cu.Ft. per Minute	Cu.Ft. per Ton of Coal Mined
		No. 1 South Seam						
20	Nov. 23, '15	Main Return	400	102	24,000	1.85	444	1,598
43*	Feb. 25, '16	Main Return	...	...	19,250	1.14	218	784
46	Feb. 28, '16	Main Return	400	102	21,000	1.28	268	964
		No. 1 North Seam						
19	Nov. 19, '15	Main Return	150	55	10,500	0.45	47	451
23	Feb. 22, '16	Main Return	170	55	8,400	0.33	27	228
44*	Feb. 28, '16	Main Return	...	..	7,500	0.27	20	169
		No. 2 Seam						
15	Oct. 21, '15	Main Return	250	86	20,000	0.87	174	1,002
32*	Feb. 23, '16	Main Return	...	..	15,700	1.42	223	1,070
33	Feb. 24, '16	Main Return	300	86	18,000	1.39	250	1,200
		"B" Seam						
21	Nov. 23, '15	Main Return	300	84	18,000	1.38	248	1,190
38	Feb. 24, '16	Main Return	300	84	19,500	1.09	212	1,017
51*†	Apr. 16, '16	Main Return	...	..	35,100	0.78	273	1,310

* Samples taken when mine was idle.

† Sample taken to replace sample lost en route to laboratory from series of February 28, 1916.

Table No. 7 gives the conditions attending the taking of samples of mine air from Seams Nos. 1 North, 1 South, 2 and B, in the Coal Creek colliery. It will be noted from the samples shown that No. 1 North and No. 1 South are less gaseous than the other seams. This is chiefly due to the fact that they have much less cover than the other seams and are being worked toward the outcrop. The volume of gas, per ton of coal mined, based on the entire set of 30 samples taken from this colliery, is 2,030 cu.ft. (Tables 5, 6 and 7.) Table No. 8 shows both the chemical and technical analyses of these samples.

TABLE 8. ANALYSES OF COAL CREEK MINE-AIR SAMPLES

(Edgar Stansfield, Analyst)

Sample No.	Chemical Analysis						Technical Analysis		
	CO_2	O	CH_4	CO	H	N	Air	Fire-damp	Black-damp
No. 1 East Mine									
25	0.08	20.35	1.87	....	....	77.70	97.23	1.87	0.90
27	0.10	20.54	1.23	....	....	78.13	98.14	1.23	0.63
39	0.09	20.49	1.49	....	....	77.93	97.90	1.49	0.61
40	0.11	20.22	2.73	....	....	76.94	96.61	2.73	0.66
41	0.14	20.06	2.97	....	....	76.83	95.83	2.97	1.19
48	0.10	20.40	1.73	....	....	77.77	97.47	1.73	0.80
49	0.12	20.36	1.67	....	....	77.85	97.28	1.67	1.05
50	0.10	20.38	2.04	....	....	77.48	97.37	2.04	0.59
No. 3 Mine									
17	0.22	20.46	2.46	....	....	77.22	96.03	2.46	1.51
22	0.09	20.56	1.03	....	....	78.32	98.23	1.03	0.74
28	0.06	20.54	1.83	....	....	77.57	98.14	1.83	0.03
29	0.09	20.65	1.01	....	....	78.25	98.66	1.01	0.33
30	0.12	20.66	1.10	....	....	78.12	98.71	1.10	0.19
31	0.15	20.32	2.29	....	....	77.24	97.09	2.29	0.62
34	0.16	20.30	2.05	....	....	77.49	96.99	2.05	0.96
35	0.10	20.55	1.15	....	....	78.20	98.18	1.15	0.67
36	0.11	20.36	2.26	....	....	77.27	97.28	2.26	0.46
47	0.15	20.38	1.89	....	....	77.58	97.37	1.89	0.74
No. 1 North Mine									
19	0.09	20.63	0.45	....	....	78.83	98.57	0.45	0.98
23	0.11	20.63	0.33	....	....	78.93	98.57	0.33	1.10
44	0.07	20.85	0.27	....	....	78.81	99.62	0.27	0.11
No. 1 South Mine									
20	0.23	20.11	1.85	....	....	77.81	96.08	1.85	2.07
43	0.05	20.66	1.14	....	....	78.15	98.71	1.14	0.15
46	0.08	20.56	1.28	....	....	78.08	98.23	1.28	0.49
No. 2 Mine									
15	0.11	20.54	0.87	....	....	78.48	98.14	0.87	0.99
32	0.09	20.40	1.42	....	....	78.09	97.47	1.42	1.11
33	0.09	20.48	1.39	....	....	78.04	97.85	1.39	0.76
"B" Mine									
21	0.13	20.47	1.38	....	....	78.02	97.90	1.38	0.82
38	0.10	20.69	1.09	....	....	78.12	98.85	1.09	0.06
51	0.06	20.67	0.78	....	....	78.49	98.76	0.78	0.46

N.B.—See note at bottom of Table 4.

The time that elapsed between the working and idle periods in the mine was so short that little real value can be placed on the variation in the volume given off;

but no opportunity was afforded for obtaining samples after a protracted suspension of work and advantage had to be taken of a single idle day or a Sunday. Feeders and blowers of gas from the roof and floor of the seams are more frequent in the Michel colliery than they are in the Coal Creek colliery; and, while it is true that following a period of "bumps" considerable gas is released from the floor in No. 2 mine, I am of the opinion that most of such gas was inherent in the coal seam.

The following analyses of the coal in Nos. 1 and 2 seams are typical of the colliery:

No. of Seam	Moisture	Volatile Combustible Matter	Fixed Carbon	Ash
1	0.84	23.59	68.40	7.17
2	1.00	21.85	71.30	5.85

As an illustration of the retention of gas within the coal, in the seams worked through Nos. 2 and 3 mines of the Coal Creek colliery, I recall some operations I supervised in No. 2 mine of this colliery, in 1902. A main-return aircourse was being constructed through an abandoned section that had been worked several years before; the pillars standing in the district being very small led to the belief that the gas would be well drained off; but in every instance the moment cutting began on one of these pillars, which were often less than 10 ft. in thickness, the emanation of gas was such that brattice had to be carried right up to the face in order to permit the continuation of the work.

The volume of gas given off appeared to be greater in the vicinity of the fault lines or those zones in the field where the coal seemed to have been subjected to pressure and crushed. In addition to this heavy emanation of gas, the coal being bituminous and friable, made much fine dust, which was an added anxiety to those in charge of the operations.

In conclusion, the foregoing tables clearly show that this coal field is very gaseous. The Michel colliery with three mines shows the average of 38 samples to be 3,837 cu.ft. of methane, per ton of coal mined, while the Coal Creek colliery average of 30 samples was 2,030 cu.ft. Taking the field as a whole, these 68 samples show an average outflow of 3,040 cu.ft., per ton of coal mined.

In Bulletin No. 72 issued by the United States Bureau of Mines, and entitled "Occurrence of Explosive Gases in Coal Mines," N. H. Darton treats extensively with the outflow of gases in the principal coal fields of the world and especially in the anthracite field of Pennsylvania and the southern portion of the Illinois field. In his summary, page 229, Mr. Darton, speaking of the outflow of gas at certain mines, says:

Among mines with large outflow of gas, those near Wilkes-Barre, Penn., lead with 2,000 to 3,500 cu.ft. per min., and some of the more fiery of the Prussian mines range from 400 to 625 cu.ft. Figures of this character have to be considered in connection with extent of workings and tonnage of output and the data for these factors are given in but few instances. In the Saarbrücken basin the volume varied from 16½ to 2,160 cu.ft. to the ton of coal mined, while in the gaseous mines near Wilkes-Barre the rate ordinarily ranged from 2,000 to 3,850, with an average of about 1,500 cu.ft. per ton. In some Austrian mines the rate ranged from 519 to 7,469 cu.ft.; at Gemeinschaft and Ath-Gouley the rate per ton was 409 to 3,360 cu.ft. and in two fiery French mines the figures given are 883 and 1,377 cu.ft. In the deeper mines in southern Illinois the amounts varied from 50 to 260 cu.ft. per ton.

The mines operated in the Crow's Nest Pass coal field, at Michel and Coal Creek, with an average outflow of 3,040 cu.ft. of methane per ton of coal mined, may therefore be classed as being among the most gaseous mines known.

Sample copies of the forms used in collecting the details of data for the chemist at Ottawa and for the chief inspector's office at Victoria, and the returns of the analyses made by the chemist are here shown, Sample No. 29 from Michel colliery being used as an illustration. Copies of the chemist's reports are mailed direct from Ottawa to the chief inspector of the province, the district inspector sending the sample, and the manager of the mine in which the sample was taken.

A reference to the table giving the chemist's returns shows but one sample of the entire 68 where the oxygen content of the mine air fell below 20 per cent. It is

the intention to continue this work during the present year; and also to conduct a series of tests on the pressure of the occluded gases in the coal of this field.

Report No. 29
Sample No. 29

Department of Mines, British Columbia

MINE AIR SAMPLES

Form or File No. ..... 1 (a)
Mine ..... No. 3 East
Situated ..... Michel, B. C.
Operated by ..... Crow's Nest Pass Coal Company
Name or No. of coal seam ..... No. 3
Ventilating district ..... Main return airway
Location in mine ..... 800 feet from fan
Barometer ..... 25.5 in. Hygrometer dry-bulb, F. ..... 40 deg.
Wet-bulb, F. ..... 40 deg. Humidity, ... 100%.
Velocity of air in feet per minute ..... 1,500 ft.
Volume of air in feet per minute ..... 120,000 cu.ft.
Pressure on air or water-gauge ..... 2 in.
Average output in tons per day from mine ..... 550 in 24 hr.
Average output in tons per day from split .....
Number of men breaking down coal in mine ..... 90 in 24 hr.
Number of men breaking down coal in split .....
Total number of men in mine..150 in 24 hr. Total number of men in split....
Mine working ..... yes. Mine idle .....
Sample collected by ..... George O'Brien. Date ..... Jan. 7, 1916.
Sample shipped by ..... George O'Brien. Date ..... Jan. 10, 1916.

Remarks: There was a ¼-in. cap of gas in the aircurrent at the point where this sample was taken. The test was made with a Wolf safety lamp. The average number of men employed on the morning shift in this mine is 76, including 54 miners.

DEPARTMENT OF MINES No. 181

REPORT OF ANALYSIS OF MINE AIR SAMPLE

LABORATORY OF FUEL TESTING STATION, OTTAWA

MINES BRANCH
Department of Mines
E. Haanel, Ph.D. Director

DIVISION OF FUELS AND FUEL TESTING
B. F. Haanel, B.Sc. Chief of Division.
Edgar Stansfield, M.Sc. Chief Engineering Chemist.
F. E. Carter, Dr.Ing., B.Sc. Engineering Chemist.

Source of sample:—The Crow's Nest Pass Coal Co., Michel, B.C.
No. 3 East mine, main return airway, 800 feet from fan.

Sample collected by:—George O'Brien,

Date of sampling:—Jan. 7, 1916. Date sample received:—Jan. 18, 1916.

Sample Number 29
Laboratory Number 181

Chemical Analysis

Carbon dioxide 0.10%
Oxygen 20.47%
Methane 1.27%
Carbon monoxide .....
Hydrogen .....
Nitrogen 78.16%

Technical Analysis

Air 97.80%
Firedamp 1.27%
Blackdamp 0.93%

Remarks

Note:—In calculating the technical analysis from the chemical analysis, the assumption is made that atmospheric air contains 20.93 per cent. oxygen, 79.04 per cent. nitrogen, and 0.03 per cent. carbon dioxide. The excess oxygen and carbon dioxide are reckoned as blackdamp, and the inflammable gases as firedamp. B.F.H.

Signed, E. Stansfield, Jan. 24, 1916.

Following is the form of report sent from Ottawa to the district inspector and mine manager.

MINE AIR SAMPLE

Department File No. 59, 115/1916. Sample No. 29
Mine.....No. 3 East. Situated.....Michel.
Operated by.....Crow's Nest Pass Coal Company. Name of seam No. 3
Ventilating district.....Main return airwgy
Location in mine.....800 feet from fan
Barometer..25.5 in. Hygrometer, dry-bulb, F..40 deg. Wet-bulb, F..40 deg.
Humidity.....100%. Velocity of air in feet per minute.....1,500.
Volume of air in cubic feet per minute.....120,000
Pressure on air or water gage.....2 in.
Average output in tons per day from mine..550. From split.....
Number of men breaking down coal in mine..90 in 24 hr. In split.....
Mine working.....Yes. Date of sample.....January 7th, 1916.
Collected by.....George O'Brien, Ottawa Laboratory No.....181.

CHEMICAL ANALYSIS

CO_2	O	CH_4	CO	H	N
0.10	20.47	1.27	.....	....	78.16

TECHNICAL ANALYSIS

Air	Firedamp	Blackdamp
97.80	1.27	0.93

Remarks: Cu.Ft. of methane per minute..... 1,524
Cu.Ft. of methane per day..... 2,194,560
Cu.Ft. of methane per ton of coal mined..... 3,990

MR. DUNLOP (*Illinois*)—Mr. President, this paper of Mr. Graham's is one of the most interesting that the Institute has been favored with for a long time and will prove of much value to all who have heard it or who will read it. There is so much contained in the paper that it is hard for one to grasp its importance in a single reading. Only by a close study will we be able to get all there is in it. I want to move, Mr. President, that we give Mr. Graham a rising vote of thanks for his well-prepared paper, because I am satisfied it will be read and re-read by all of our members.

The motion to extend to Mr. Graham a hearty vote of thanks for his well-timed paper, being duly seconded, was unanimously adopted.

MR. GRAHAM—I thank you, gentlemen, for your kind appreciation of my efforts. I am only sorry that I did not have the time necessary to make slides of the tables, so they could have been shown here.

THE PRESIDENT—I think, as Mr. Dunlop says, that it is a paper we will have to read and study in order to gain its full benefit.

Mr. Rutledge (*Oklahoma*)—Recently I heard quite a discussion about a statement made by an engineer of standing, who had lately come from Alberta to southwestern Missouri. The statement was to the effect that in loading coal in his former district, they were able to detect methane in the lumps of coal being loaded. This, of course, aroused quite a discussion, and I would like to ask Mr. Graham whether that is possible.

Mr. Graham (*British Columbia*)—I might say, in answer to that question, that I have entered places in the mine where coal was being loaded at the face and, on making an examination of the place for gas, failed to discover any; but, on setting my lamp down on the broken coal, the presence of gas would be easily detected. I have also seen a hole dug in a car of coal, as it came out of the mine, and the safety lamp showed gas coming from the coal.

Mr. Bohlander (*Illinois*)—I would like to ask Mr. Graham a question. It seems plain that you have plenty of gas up there. Now, if they should increase the output to, say 8,000 tons a day, as we do in Illinois, how would they handle that gas?

Mr. Graham—It would be absolutely impossible to take care of the gas in a mine producing that amount of coal. In some instances we find it requires a circulation of 1,000 cu.ft. per min. in a split, for every man employed in breaking down coal. In few instances only are we able to carry air for more than twenty men breaking down coal, because the gas issues to such an extent that it would become dangerous.

Mr. Back (*Illinois*)—Mr. Graham says that in working a 40-ft. seam of coal they only take out 20 ft. and in a 10-ft. seam they take out only 5 ft. I would like to ask, Why do they leave half of the coal unmined?

Mr. Graham—The reason for leaving the coal is, that the part left behind is more or less dirty and bony and would require much washing. Like other mining countries, we are prodigal with the things that nature has so abundantly provided.

Mr. Hill (*Missouri*)—May I inquire how much cover you have on your coal there, Mr. Graham?

Mr. Graham—At the point where the break is shown in the strata, the cover is about 1,200 ft. In No. 2 and No. 3 mines, the present working has about 1,400 ft. of cover. As the mine is extended, this will increase to pretty nearly 3,000 ft. I draw attention to the fact that the field is opened by drifts and that the mountains rise precipitately on each side of the creek. There are many lateral cross-cuttings coming in on almost three sides, and the pressure from the overlying strata is sometimes very severe on this account.

The President—I would like to ask if you have any trouble in supporting the roof and in keeping the pillars from creeping and crushing?

Mr. Graham—In the early stages of the development, little attention was given to pillars, and I believe that is largely what caused the "bumps" in 1907-8. After the government placed restrictions on operations in some sections, development was abandoned completely. With the new method of opening, we have had very little trouble in supporting the superincumbent strata. The pillars, as a whole, are run more or less on a trial system, the intention first being to leave pillars not over 100 ft. wide and break them only at distances of 500 ft. apart. However, we found it absolutely impossible to carry the pillars unbroken to that distance. Instead, the distance has now been reduced, as this was found to be necessary on account of the gas coming in.

Mr. Flynn (*Alabama*)—What percentage of the coal is now being removed?

Mr. Graham—At the present time we are taking out about 25 per cent. of the seam.

Mr. Back—I notice that Mr. Graham, in his paper, remarked on the fine coal coming out of the drift mouth at the time of an outburst of gas and likened it to smoke—the result of the displacement of hundreds of tons of coal in the mine. I wish to ask, Is the gas pressure so strong that it crushes hundreds of tons of coal or is this dust that had accumulated at the mouth of the mine and was blown out when the explosion occurred.

Mr. Graham—The coal displaced was, in some instances, over 3,000 tons, which was blown directly from the solid coal face.

Mr. Paul (*Pennsylvania*)—I think if we had heard Mr. Graham's paper only, we would have been well repaid for coming to Joplin. I much regret that other members of our Institute have not taken the same pains to present papers on similar live topics. This one of Mr. Graham's has been exceedingly interesting to me and I am sure has been the same to all present.

There are a few questions that came to my mind during the reading of the paper, and I will be glad to have Mr. Graham reply to them.

First, he refers to one split in a mine containing 1.64 per cent. of methane where the circulation was 96,000 cu.ft. per min. Assuming a sectional area of 80 sq.ft. gives a velocity of 1,200 ft. per min. It would be interesting to know the velocities of the air currents in these various splits where such large volumes of air are passing.

Again, during the reading I made some mental calculations, which lead me to believe that the daily production of coal ranges from three to five tons per man employed in the mines.

I would like, also, to learn the manner of mining the coal, whether by machinery or by pick, and the character of explosives used, if any, in blasting down the coal.

Further information on these points will be of interest to many members, who are absent, and who will read the proceedings when published, and appreciate being enlightened.

Mr. Graham—In answer to the first question I will say, The velocity of air in a main-return airway, in that particular field, will range generally from 80 to 120 ft., but in many instances they reach 1,000 ft. per min.

The tonnage named by the secretary is about correct. It ranges from three to five tons per man employed.

The coals are very soft and explosives are used in but few instances, and then only such as are on the permitted lists. Owing to the fact that we have no testing stations in British Columbia, those explosives that appear on the permitted lists of British Columbia and the United States

are used. There are, at the present time, only four or five on the permitted list in our province. However, the quantity of explosives required is very limited. For the year 1915, I think the amount of coal produced in that field, including what was used by the companies, was 52 tons per pound of powder used and this included rock-work. No machines are used in the field—all mining is handwork.

THE PRESIDENT—Are electric coal-cutting machines and electric lamps used in these mines, and do you recognize them as being safe for mining use?

MR. GRAHAM—We do not permit electricity in the mines; it must all be kept on the outside, which prevents the use of electrical coal cutters. We recognize portable electric lamps as perfectly safe and would permit their use to a limited extent; but, so far, they have not been extensively adopted in our mines.

MR. BOYLE (*Oklahoma*)—I want to ask if the fatalities have been decreased by reason of special statute in British Columbia, or by virtue of any order of the mining department, since the mining of coal began in your province.

MR. GRAHAM—The Coal Mines Regulation Act of to-day is the same as it was when first introduced in 1877. It requires 100 cu.ft. of air per man employed in the mine, although an inspector has the right to require a greater quantity at any time when he considers a greater quantity necessary. He must then post an order to that effect and also send a copy of the order to the manager. The law permits the inspector to demand that the quantity be increased as he may deem necessary.

MR. PAUL—Upon what basis does your department determine the volume of air required with respect to the percentage of gas present. I notice that in your paper, in one split of 18,000 cu.ft. of air, you mention 3.33 per cent. of methane. I want to ask, What margin above that percentage would your department recognize as safe? Suppose the gas should run up to 4 per cent., how much additional air would be required by your department?

MR. GRAHAM—In that particular case where 3.33 per cent. of methane was shown, the quantity of air in that district would be immediately increased to correspond to

the number of men worked, which would reduce the percentage of gas in the return air. In many instances men have to be taken out of the district entirely for a limited length of time. There are, I think, two such instances I could show you in one of the collieries. In July 8, 1915, No. 3 Split, in No. 3 Mine, was producing 200 tons of coal per day. The volume of air passing was 7,500 cu.ft., containing 3.83 per cent. of methane. The men were immediately withdrawn. The aim of the inspector is to keep the returns from the various splits as near to 2½ or 3 per cent. of gas as possible, not permitting them to exceed that amount.

Mr. Paul—You say that in no instance did the oxygen content fall below 20 per cent. Do you rely upon the oxygen content of the air as a basis for ventilation?

Mr. Graham—According to the English law, the percentage of oxygen in a mine must not fall below 19 per cent. in a ventilating current. There is only one instance recorded in which the oxygen has fallen below 20 per cent. and in that case it was 19.94 per cent. The percentage of oxygen is not considered where the question of gas is concerned, except to show the relative proportion of oxygen and gas. The assumption is that atmospheric air contains 20.93 per cent. oxygen, 79.04 per cent. nitrogen and 0.03 per cent. carbon dioxide. Carbon dioxide gas is reckoned as blackdamp and the inflammable gases as firedamp.

The President—May I ask what precautions are taken to prevent men from taking matches or fire-producing elements into the mines.

Mr. Graham—Any official in a mine has the right to search an employee for matches at any time, and that is quite frequently done. For many years the penalty meted out was simply imprisonment of from five to ten days. In later years, in our province, all men engaged in breaking down coal at the face must hold a mining certificate. Recently, we have been compelled to cancel the certificates of men convicted of having a pipe, tobacco or matches in a gaseous mine. In the last two years men have received sentences of from 30 to 90 days for having matches in their possession in the mine.

THE PRESIDENT—I would like to inquire in regard to the safety lamps and the kind of igniters used? Also, what is the rate of fatality in the mines of the province?

MR. GRAHAM—We use the serum ignitor. No lamps are opened in the mine at all. The lamps have an automatic lock. The fatality rate is 4.7 per 1,000 persons employed. We had one accident in which 41 lives were lost and the fatality rate increased to 10.7, which increased our 10-year average from 4.7 to 9.6 for that period. We do not figure fatalities per ton, but per thousand men employed.

THE SECRETARY—It has been proposed, there being a number of inspectors here who have not had an opportunity to visit any of the metal mines or mills of this district, that we have no session this afternoon, but take the afternoon to visit some of the mines and mills in the vicinity. I would suggest that prior to our visit it would be well to learn something of the field; what is mined there; what is the character of the ore and how they mine and mill it. Mr. Harlan, inspector for one of the districts near Joplin, and Mr. Holmes, also inspector, are both full of information on this subject, and I am going to ask the president if he will not call upon Mr. Harlan to give us a few remarks.

THE PRESIDENT—We shall indeed be pleased to hear from Mr. Harlan along the lines mentioned by our secretary.

MR. HARLAN (*Missouri*)—The formation of the Joplin district is so varied that it is impossible to give a definite description of it. The formations consist of the various soils, clays, flints, limestone and soapstone. In some places, in sinking a shaft, one encounters lime at 6 ft.; in other places it is possible to go 200 ft. without striking it. The sheet-ground or blanket veins contain the largest mines and the limestone there is generally from 10 to 200 ft. thick. Sometimes, in sinking a shaft, one strikes 20 ft. of lime, sometimes 100 ft. and then may come a soft formation, when the shaft will require cribbing only from the limestone, while in other shafts it is necessary to crib from top to bottom.

The lead in this district is a very high-grade ore, or soft lead. It assays from about 80 to 83 per cent., while the zinc may run from 55 to 64 per cent. The ore is acknowledged to be about the best in the country. It is used for galvanizing purposes and to make rolled zinc. The deposit in the sheet-ground formation lies in a blanket vein. There is usually a strata of hard chert (flint) in the top of the vein and the lead seams are, as a rule, above the zinc; which will mean, in sheet ground, a face of from 7 to 20 ft. thick. Beginning at the top, there may be first a streak of lead, then a streak of flint and then a streak of zinc. These streaks vary from ½ in. to 6 and 8 in. in thickness. In other words, as nearly as I can define it, the formation resembles a piece of bacon—a streak of fat and then a streak of lean. The soft-ground mines lie in pockets, that are in places near the top of the ground, with 40 to 50 ft. of cover; while in other places the ore is mined at a depth of 200 ft. The soft ground contains very little lime and requires heavy timbering.

In the sheet-ground mines air machines are used; but the soft-ground mines employ hand steel. The ore is hoisted in buckets instead of cages: the buckets hold from 800 to 1,600 lb. of rock. The 800-lb. cans are suspended on a ½-in. cable, while the 1,600-lb. cans use a ¾- to ⅞-in. cable. The power used for hoisting is electricity and steam. There are three kinds of power in the district; namely, steam, electricity and natural gas.

The material as taken from the ground is called "dirt." It is dumped on a screen and the coarse stuff containing no ore separated, run out on a tramway and dumped as waste. The dirt containing ore passes through the screen into a large dirt hopper, holding from 200 to 600 and 700 tons. It is then passed into a crusher or ore breaker through a feeder that allows it to pass only as fast as the crusher needs it. The material is there crushed to a maximum size of, perhaps, 2 in., or an occasional particle may be as big as the fist.

The crushed material is fed by gravity onto Cornish rolls, where it is reduced to particles from ½ to ⅞ in. in size. From the rolls it passes to an elevator termed

the "dirt elevator" and from the dirt elevator to a revolving screen of ½- to ⅞-in. mesh. The particles that will not pass through the mesh are returned to another set of Cornish Rolls, called the "return rolls," while the particles passing through the screen are sent directly to the "rougher" jig. This jig is equipped with a plunger and stationary grates. The plunger forces the water up through the grates and the ore, being heavier, sinks to the bottom, while the tailings or chats pass on. The grate openings of the "rougher" are from ⅛ to $\frac{3}{16}$ in. wide. The coarse ore is drawn off through a gate above and the fine ore passing through the grate is drawn off by a faucet.

From the rougher jig the ore passes to an elevator that raises it to another screen, where it is sized and goes on to what is called the "cleaner." The material passing through this jig is practically sand. The jig works the same as the rougher jig. The fine sand and stuff passes off as chat while the ore from the jig grates, which are ⅛ in. and sometimes even smaller (depending on the ore, some in the district being very light and chaffy) is cleaned and comes out about 60 per cent. ore. The sand coming from this cleaner goes to a sludge tank into which the water is run from the cleaner. There is a dewatering screen on the end of the rougher. From the sludge tank the fine sediment is run into an elevator and then over classifiers, the coarser stuff going to a "rougher" sludge table and the screened passing to the regular tables. The lighter stuff is then carried to what is called a "slimes table." It does not require much water as it floats readily.

The majority of the ore from the district assays about 60 per cent. The tailings or chats, in former years, ran about 1½ to 2 per cent. under the old method of cleaning, but the uptodate concentrating plants have reduced this loss.

The dirt, as it comes from the mine, runs 2, 3 and 5 per cent. ore. A 3 per cent. mine is considered a good proposition.

There are mines being operated in this district today which could not have been worked ten years ago, at the same prices for ore. The mines are now taking up a flotation system, but as yet it is experimental and a question

as to whether the cost of it will permit the handling of the ore at a moderate price. The prices have fluctuated because of the war, but under normal conditions they average from $50 to $60 per ton. The explosive used in the district is dynamite.

THE SECRETARY—For the benefit of those members who have never seen a mill in operation, I wish to ask how the zinc and lead ores are separated.

MR. HARLAN—The lead ore being the heavier, stops on the first cell of the jig, while the second cell catches the zinc. While the most of the lead is caught in the first cell or partition of the jig, there may be some fine lead and stuff in the second cell, which is drawn off and run back. The third cell catches the clean zinc. They regulate the action of the plunger by an eccentric on the jig, so as to prevent the float lead from being carried over. In former years, they had a great deal of trouble with sluice water, but now they have improved on the process, until the zinc runs less than ½ or ⅜ of 1 per cent. lead. In order to get top prices for ore it is necessary to keep the lead under ½ of 1 per cent.

MR. RUTLEDGE (*Oklahoma*)—You speak of 5 per cent. dirt; is that determined by assay?

MR. HARLAN—Yes; that is the assay.

THE SECRETARY—I think it would be interesting to make some comment on the fatalities.

MR. HARLAN—To within the last three years no provision had been made to keep down the dust, which became quite a menace to the district. Men contracted tuberculosis, until the average life of a miner working at the head of the drift in a sheet-ground mine, blowing dry holes and squibbing was only about 6 or 7 years. There was great complaint made about it and when the present inspectors came into office, Mr. Hill asked if something could not be done to allay the trouble.

Mr. Burch, Mr. Holmes and myself had already agreed that we would specialize on the dust problem, as that was the worst thing with which we had to contend. We went to the American Davey mine, one of the largest in the district, and made an inspection and looked over the condition, as the dust question in that mine was considered

the worst in the district. After our inspection we talked to the manager, Paul Amos, who asked what we had to suggest, stating that he was glad we were going to take up the rock-dust and sanitary conditions, because the trouble had reached a point where something must be done.

We learned that of the 500 men who had worked there during the last seven years, there were only 50 living. We suggested that there must be coöperation in the work and that the American-Davey, being the largest company in the district, call a meeting of the operators to take up the question and assist the inspectors in the matter. A week later a meeting was called at which 45 or 50 operators were present. In stating the object of the meeting, I urged that something be done, since five times more men were dying of tuberculosis than were being killed in the mines, and it was up to the operators to do something. I suggested that if they did not the Federal Government would step in and do what the operators might not like.

Plans were discussed and we organized what is called "The Southwestern Safety and Sanitation Association." As I have said, the law did not make any provision regarding dust in the mines, so we at once took up the question of the installation of independent water lines leading to the head of all drifts, so that a man could use the water to wet the hole before blowing it and then sprinkle the place to keep down the dust. At that time the ore was bringing only $40 to $50 per ton, and we realized we would have trouble in forcing the installation of the water lines. Many objected on account of the cost of the equipment, which was from $5,000 to $7,000. However, we went ahead.

Later, we succeeded in getting the Rescue Car down here to demonstrate first-aid work and Mr. Young made a report to Washington, D. C., concerning the dust conditions. In the meantime we organized the Anti-Tuberculosis Society, and a Mr. Higgins was sent here from Washington to investigate conditions.

About that time the price of ore changed and we decided that it was a good time to get in the water lines and adopt the water machine while the price was high. We succeeded in demonstrating that the drilling capacity of

the water machine was greater than that of the dry machine, it taking the dry machine three days to drill what the wet machine accomplished in two. Or on a tonnage basis, the wet machine drilled 65 tons, while the dry machine made but 40 tons. Many operators readily saw that it was a business proposition and adopted it. In a short time the American-Davey had 32 water lines run, and the Vogey mine was also equipped with these lines; and now almost every sheet-ground mine in the district is using the water lines and wet machines.

We decided, however, to take steps to secure some legislation on these subjects. To this end we formulated three bills, which we presented to an executive committee of operators and asked their assistance. We called up Mr. Hill, and he advised us to see our representatives and senators as soon as possible. There was a little hitch over the question of shower baths and independent water lines leading to all faces, but with some slight changes the bill was enacted and became law. The sanitary conditions were bad; the men were drinking out of old kegs and we asked for a water line running down the shaft, to supply the men with drinking water, and a bill making that provision was formulated and passed. Since these changes have been made, conditions are 100 per cent. better than they were ten months ago.

THE SECRETARY—I would like the records to show the tonnage of ore loaded per day, as this field is considered one of the greatest lead- and zinc-producing fields in the world. Statistics on coal mining in some districts show an average of 3 to 5 tons of coal mined per man per day, while in other districts where men do nothing but load the coal the average is from 8 to 10 tons per day. Perhaps Mr. Harlan can tell us how many of these cans the shovelers will load per shift.

MR. HARLAN—That varies according to the experience of the shoveler, the air and surrounding conditions. It is difficult to estimate what the correct average would be, but they generally run from 25 to 80 cans per shift. During a contest here one shoveler made 200 cans in a single shift. While some shovelers make $5, others earn $7 and $9 a day.

Mr. Holmes (*Missouri*)—I want to correct one of Mr. Harlan's statements, as we do not want you to get a wrong impression of this district. In giving an idea of the average tonnage per man per shift, Mr. Harlan should have said 100 cans or 50 tons. In some places in the district mining has been carried on for fifty years, and we want, this afternoon, to take you to one of these mines, known as the "Oronogo Circle," which has been in operation fifty years and there is yet 20 years of work in sight. I do not want you to think this is a short-lived district, because it is not.

On motion duly made and seconded, the meeting then adjourned until 10 o'clock, Thursday morning.

Thursday Morning, June 15, 1916

The meeting was called to order, at 10 : 15 o'clock, by President Sylvester, who announced that the chairman of the membership committee would make further report.

Report of Committee on Membership

To the 9th Annual Meeting of the
Mine Inspectors' Institute of U. S. A.:

The Committee on Membership report and recommend that the following named persons be elected members of this Institute:

Kansas:

Charles E. Paisley, State Mine Inspector.
Martin Kotzman, State Mine Inspector.
James Sherwood, State Mine Inspector.

Indiana:

Michael Scollard, Chief Mine Inspector.

George Hill, Chairman,
Edward Flynn,
Thomas P. Back.

Joplin, Mo., June 15, 1916.

On motion, duly seconded, the report of the Committee on Membership was adopted by unanimous vote and the candidates received at once into full membership.

The president then asked if the Committee on Resolutions was ready to report.

Report of Committee on Resolutions

Mr. Rutledge (*Oklahoma*)—As chairman of the Committee on Resolutions I will offer the following resolution on the death, since we last met, of a distinguished member of this Institute, Dr. Joseph A. Holmes, late director of the Federal Bureau of Mines.

Resolution on the Death of Dr. Joseph A. Holmes

Since the last annual meeting of the Mine Inspectors' Institute of the United States of America, at St. Louis, Mo., June, 1915, the Institute has lost, by death, Dr. Joseph A. Holmes, the first director of the United States Bureau of Mines. Doctor Holmes was a valued member of this Institute, and always took an active interest in its work.

In his death we recognize that the mining world in general, the United States of America and this Institute, in particular, have sustained a great loss.

By his tactful and untiring efforts to reduce and prevent the loss of life in coal and metal mines, the introduction of artificial breathing apparatus into the mines of this country, the instruction of miners in rescue and first-aid work, and by the organization of the many scientific investigations now being conducted by the Bureau of Mines, Doctor Holmes has been of inestimable value to our mining industry.

As members of the Mine Inspectors' Institute of the United States of America, we desire, in this the ninth annual meeting, to place on record our high regard for the memory of our deceased brother, and to show by this act due appreciation of our loss.

J. J. Rutledge, Chairman,
Thomas Graham,
W. E. Holland.

The committee also desire to present the following for the consideration and action of the Institute:

Resolution of Acknowledgment

Be it resolved that the Mine Inspectors' Institute of the United States of America, at its ninth annual meeting, held in the City of Joplin, Mo., June 13-16, 1916, de-

sires to place on record and express to the operators of the Joplin district, the mine inspectors of Missouri and, particularly, to the metal-mine inspectors of the Joplin district, their appreciation of the pleasurable and profitable entertainment accorded the Institute, its members and their guests, throughout the session now drawing to a close.

J. J. Rutledge, Chairman,
Thomas Graham,
W. E. Holland.

On motion, made and seconded, the report of the committee was received and both of the resolutions presented were unanimously adopted.

Mr. Flynn (*Alabama*)—I would like to ask the privilege of submitting for consideration of the members, at this time, an amendment to our Constitution.

The President—We will hear it now, Mr. Flynn.

Proposed Amendment to the Constitution

Be it resolved that Art. 7, Sec. 1, be and hereby is amended to read as follows:

The annual meeting of this Institute shall be held each year, beginning on the second Tuesday in May, at such place as shall be designated by the vote of members, at the time of adjournment of the preceding annual meeting.

Let me say for the information of all that the only alteration this amendment will make is to change the time of our annual meeting from the second Tuesday in June to the second Tuesday in May. Quite a number of our members have children in school, some of whom have graduating exercises and class meetings at this time. The schools usually close about the middle of June, and many may wish to attend the exercises of the schools. I would not have been here today were it not for the fact that my employer insisted on my coming. I have two girls at home who were anxious that I should attend their class-day exercises. In speaking with other delegates I find others are in the same position. Next year one of my children graduates and the class-day exercises will be

about this time, and I shall be unable to meet with the Institute unless the time of meeting can be changed. I think it would be more convenient to most of the inspectors to have our meeting come in May instead of in June.

THE PRESIDENT—That is a question that must be carefully considered. We shall be glad to hear from others on the subject.

MR. REID (*Illinois*)—To make the meeting any earlier would interfere with different meetings of the operators and miners. It might be better to make the time of our meeting a little later in June or even in July.

MR. BACK (*Illinois*)—I heartily agree with what my friend, Mr. Reid, has said. In Illinois we hold meetings of the Mining Institute in the months of May and November, and the change to May might conflict with that meeting. But I realize that Illinois is only one state and this organization embraces every state in the Union, and we may be able to arrange to hold our meetings in Illinois a little earlier or later. I know if this meeting was to be held in May it would suit the inspectors of Missouri, Kansas, Oklahoma, Texas and Arkansas better than to hold it in June. In Illinois the busy season will not begin for a couple of months yet; but, in this section, now is the busy season. I think, therefore, if the meeting was held in May, it would be better.

MR. FLYNN—If that date is too early, it would be satisfactory to me to make it later, say the third Tuesday, instead of the second Tuesday of May. My desire was to suggest holding the Institute meeting earlier or later.

MR. PAUL (*Pennsylvania*)—I concur in the amendment offered by Mr. Flynn. I know of a number of members who have been prevented, at different times, from attending our meetings, by reason of their sons and daughters taking part in the school exercises. I believe that children are always desirous of having their parents and grown-up friends present when affairs of that nature are going on. I may say that I have not been able to attend any of my own class meetings, since the organization of this Institute, both are held the same week. I know of members who have been unable as yet to attend a single meeting of the Institute, and have resigned their membership on ac-

count of our meeting interfering with the school functions. I believe it will be the pleasure of the Institute to change the date of our meeting to the second Tuesday in May or some later date.

Mr. Graham (*British Columbia*)—Being the lone and solitary member present from the Far West, I presume my comments are not worthy of much consideration. However, I will say that to make the meeting earlier would be inconvenient for me. The heavier portion of my work commences about the early part of February and continues through May. I sympathize with others on the school question, as I am in practically the same position myself. I often feel when starting on these trips that I would like to take my children with me, but to do so would be taking them away from at least a month of school. July would suit me better than either May or June.

Mr. Boyle (*Oklahoma*)—I move to amend Mr. Flynn's resolution by striking out the words "second Tuesday in May," and inserting in their place the words second Tuesday in July.

Mr. Flynn—Mr. President, the amendment of Mr. Boyle is satisfactory to me, and I will move the adoption of the resolution as thus amended.

Mr. Back—If it is in order to pass on this resolution to amend the Constitution at the present time, I second the motion.

On calls for the question the motion for the adoption of the amended resolution was put by the president and adopted by unanimous vote.

It was then moved and seconded that the report of the Auditing Committee be adopted, which was also done by unanimous vote.

Election of Officers

The president then asked for nominations for tellers in the election of officers for the ensuing year, and Messrs. Dunlop, of Illinois, Flynn, of Alabama, and Scollard, of Indiana, were nominated as tellers to count the ballots. The three persons nominated were elected by acclamation and at once proceeded with their task upon receiving the sealed ballots from the secretary. While this was being

done, the secretary announced that through the courtesy of Mr. Pellegrino, inspector of mines, Pittsburg, Kan., there was present a man to demonstrate a device for shot firing by a pneumatic process, and suggested that the Institute take a recess and observe the demonstration of the machine, which proved of interest to all.

Following this demonstration of pneumatic shotfiring, Secretary Paul presented an interesting paper that had been prepared and forwarded to the Institute by Edwin Higgins, chief mine inspector of the State of California. He stated that California has only recently appointed a mine inspector, who works under a commission, as explained in the paper. Owing to lack of time the reading of the paper was omitted and it was ordered printed in the proceedings of the Institute. It describes what the inspector is doing to arouse interest in safety in mining. The meeting then adjourned until 3 o'clock.

CALIFORNIA MINE INSPECTION AND THE SAFETY-BEAR MOVEMENT

By Edwin Higgins*

California is the only state in the union in which the inspection of mines is prosecuted through coöperation between the Federal and State Governments. In 1913, William J. French, member of the California Industrial Accident Commission, laid before Van H. Manning, then assistant director (now director) of the U. S. Bureau of Mines, a coöperative plan whereby mine inspection in California could be carried on jointly by the Federal and State Governments, so that duplication of effort would be eliminated and an earnest attempt made to render service to those following the hazardous occupation of mining. The plan was approved by the late Dr. Joseph A. Holmes, then director of the Bureau of Mines, and resulted in a coöperative agreement between the State Government and the Bureau of Mines.

Organization—On Jan. 1, 1914, H. M. Wolflin, a mining engineer of the Bureau of Mines, was assigned to California to organize the Mining Division of the Industrial Accident Commission. Mr. Wolflin spent two years studying conditions in California mines, aided later by an able

*Chief mine inspector, San Francisco, Calif.

corps of deputies. With this preliminary investigation as a basis, and with the assistance of a committee consisting of mine operators and miners, Mr. Wolfiin then drew up a tentative set of mine-safety rules, which were printed and distributed throughout the state to those interested in mining. Public hearings were held and a final draft of the rules prepared for presentation to the Industrial Accident Commission. These were adopted by the Commission and made effective Jan. 1, 1916. The Workmen's Compensation, Insurance and Safety Act gives the Commission power to make and enforce safety rules and regulations, to prescribe safety devices, to fix standards, and order the reporting of injuries.

Administration—On Jan. 1, 1916, Mr. Wolfiin was appointed mine-safety engineer for the U. S. Bureau of Mines, and I was myself assigned to the California cooperative work with the title of chief mine inspector. Three deputy inspectors after qualification by a competitive examination, were appointed to assist in the work. Mines in California had never before been worked under state supervision, and some operators were apprehensive that the administration of the mine-safety rules might work a hardship on them. Thanks, however, to the spirit of coöperation established by the Commission, there has been no objection raised by any operator in the state.

Every effort has been made to make the Mining Division of the commission a source of help to the operators. In no case has it been necessary to invoke the law for the enforcement of any of the mine-safety rules. Bulletins are published once each month, in which are discussed various features of mine-safety work and safety and efficiency devices, copies being distributed free of charge to operators.

The Safety-Bear Movement—Believing that it is essential to secure the coöperation of miners in safety work, I conceived the plan of organizing what is known as the Miners' Safety-Bear Club and to enlist as many of the miners in the movement as possible. Letters outlining the plan were sent to operators and others, to be delivered to miners throughout the state. The response was almost instantaneous and gratifying. Three Safety-Bear rallies

were held in as many mining camps. The programs included motion-picture films, loaned by the Bureau of Mines, first-aid demonstrations, music and speeches. Fifteen hundred miners attended, a majority of whom became members of the club. In two months the membership of the club totaled 3,700, and it is hoped soon to enroll most of the 12,000 or 13,000 miners in the state.

The first of the circular letters sent out, to which I have just referred, was dated Mar. 15, 1916, and the second a month later. These letters were pithy and to the point, making clear to the miner that he will be amply compensated for his efforts in helping the mine inspectors to make the mines safe. A few extracts only of these letters can be given here, but full copies of the letters can be obtained by writing to the State Mining Department, San Francisco, Calif. Following are a few extracts:

In talking about safety with men in the mines I have often heard the remark "What's the use? What do we get out of it? The company is the only one that is benefited." Now, right here is where a big mistake is made. I submit that the miner is far and away the greatest gainer from safety work. . . .

What is compensation? You who have a family? Is there anything that can compensate you for the loss of your life; the loss of a leg; a hand; or the mutilation of any other part of your body? Is there anything that can compensate you for walking around on a wooden leg, or having to stand on a corner with a tin cup tied around your neck asking for help because you are blind? . . .

The day is coming soon when the mines in this state will be made as safe as possible. The work may be slow, but it is sure. Safety in mines cannot be had without the active help of you miners. What good are safety devices if men will not take care of themselves? I hold that almost the whole problem is up to you boys.

Look out for the other man, you might hurt him.

Recklessness is no indication of courage; brave men are always cautious.

Never do anything that you know is dangerous, in order to show some one else that you are not afraid to do it.

Look out for the greenhorn and show him how to keep from getting hurt.

Get the safety habit—it is a habit that will never injure you.

A broken rule often means a broken bone.

A month later another letter was prepared and sent out to be distributed broadcast among the miners in many states. This second letter contained the following good and wise suggestions that appealed strongly to most every miner.

QUESTIONS AND ANSWERS

Believing that miners possess a great deal of valuable knowledge regarding safety, I thought that some good ideas, not to be found in textbooks, can be learned if "Safety Bears" will take an interest in the Question and Answer department. So I am going to ask two or three questions relating to safety and ask those who have ideas to answer them. Answers must be short and to the point. As many as possible will appear in the next Safety-Bear letter. Following are the questions:

1. How can a miner protect himself from accidents due to falls of rock or ore? During the first three months of this year four California miners were killed and many others injured from this cause.

2. What is the best method for recovering a misfired hole? During February of this year one California miner was killed and three others severely injured as a result of missed holes.

3. What is a "Safety Bear"?

I am going to submit below what appeals to me as the qualifications for a finished "Safety Bear." See if you can improve on my idea:

A SAFETY BEAR IS A MAN

Who knows the value of perfect health and a sound body;

Who has a wholesome respect for physical suffering;

Who realizes the mental anguish and suffering that will result to those who love him and depend on him, if he is killed or injured;

Who realizes that his fellow-workmen also have those at home who love and depend on them;

Who knows that he will be safer at his work if he is careful;

Who knows that he can prevent injury to others if he will but make the effort;

Who believes that by his actions he can help to reduce misery and suffering and do much to prevent the growth of the list of widows and orphans;

Who knows that he is a worthless citizen if he passes through life without doing something to help his fellow-man.

Every normal man can be a Safety Bear if he will devote some thought to the subject in order to develop himself along these ideal lines.

Would you be happy? Use water plentifully, both internally and externally; eat moderately; laugh heartily; think a great deal and play a little; keep your head cool and your feet warm; do not overwork, nor yet be a sloth; get sufficient and regular sleep; be decent to yourself and your associates.

The letter closed with the following verses of an unknown author:

WHAT DID YOU DO?

Did you give him a lift? He's a brother of man,
And bearing about all the burden he can.
Did you give him a smile? He was downcast and blue,
And the smile would have helped him to battle it through.

Did you give him your hand? He was slipping down hill,
And the world, so he fancied, was using him ill.
Did you give him a word? Did you show him the road?
Or did you just let him go on with his load?

Do you know what it means to be losing the fight,
When a lift just in time might set everything right?
Do you know what it means—just the clasp of a hand—
When a man's borne about all a man ought to stand?

Did you ask what it was; Why the quivering lip;
Why the half-suppressed sob and the scalding tears drip?
Were you brother of his when the time came of need?
Did you offer to help him or didn't you heed?

Thursday Afternoon, June 15, 1916

The meeting being called to order by the president promptly at 3 o'clock the subjects previously announced for informal discussion, were taken up, the following being the first one. The discussion was opened by C. H. Nesbitt, chief mine inspector of Alabama.

Use of Permissible Explosives in Alabama Mines

Mr. Nesbitt (*Alabama*)—I did not come prepared to make a lengthy talk. In fact, I can only speak from a practical experience gained in the past five or six years, since assuming the office of chief inspector. I am unable to say just when the use of permissibles started in Alabama. It was probably seven or eight years ago. Since that time it has increased gradually, year by year.

We have recently compiled tables showing the percentage of permissibles used in the different counties of the state for the last two years, on a tonnage basis. For the year 1913, for the entire state, I believe we used 68 per cent. permissibles and 32 per cent. black powder, and about the same for the years 1914 and 1915.

The Alabama field is divided into four different groups: The "Warrior field," which is the Birmingham district proper, is hard coking coal; the "Cahaba field," which is hard domestic coal, and the "Coosa" and "Plateau" fields.

In the Cahaba field, it is purely a commercial proposition. Many of the operators claim they have never been able to get a permissible explosive that would not give a considerable percentage of lump coal. All the coal in this field is washed and culled and they do not care to produce lump coal.

In Jefferson County, which is the largest producer in the state, the proportion runs about 90 per cent. permissible and 10 per cent. black powder; and in Tuscaloosa, where the coal is a coking coal, it runs about 95 per cent. permissible. Some permissibles are used in the Cahaba field in drifting.

In the Warrior field, which comprises the counties of Walker, Winston and Cullman, permissibles are used to some extent; but, as they have long been in the habit of using black powder, it is hard to induce the miners to use permissibles. The operators claim they would use them if there were no objections on the part of the miners.

We feel that the use of permissible explosives in our state has been a great saving and a large factor in mine safety. We have some mines that are dangerous and must be watched all the time. They are gaseous and contain considerable dust. To use black powder in these mines would be extremely dangerous. This is well known both to the miners and operators and I do not believe they could be induced to go back to black powder. We have some records of blownout shots, that occurred several years ago, caused by the use of black powder and which resulted very disastrously. Then, we have had a number of local accidents where men would ignite a keg of powder in making up shots with open lights. In the use of permissibles this, of course, is eliminated.

There is one thing that is hard to regulate in permissibles and that is, the proper charging of the holes. I have known of cases where men wanted to use seven or eight sticks, while the Bureau of Mines specifies something like four sticks to a charge. In many instances that

amount is exceeded. On the whole, every thing is working out very satisfactorily and I feel it has been a great saving to us.

Mr. Back (*Illinois*)—I worked in Bibb County, Alabama, over 30 years and the Cahaba and Warrior fields mentioned by Mr. Nesbitt are new to me. I would like to ask, In what field is Bibb County?

Mr. Nesbitt—Bibb County is in the Cahaba field.

Mr. Back—You say that in these fields they use as high as 90 per cent. of permissible explosives. I would like to ask if that is in blasting down solids. Because, I have been in mines all my life and have always used black powder. I have considered permisibles not good to use in blasting out solids, as they do not give the same efficiency.

Mr. Nesbitt—Permissibles are used in solid blasting in Tuscaloosa and Jefferson counties.

Mr. Scollard (*Indiana*)—About what is the amount specified for a blast and what would be its equivalent in black powder?

Mr. Nesbitt—Four sticks is the usual charge of permissibles, which would be equal to about two pounds of black powder.

Mr. Scollard—There is a law in our state that forbids a miner to use more than six pounds of black powder, but they sometimes use eight.

Mr. Flynn (*Alabama*)—The company I work for use permissibles wherever practicable. We use it in the Pratt field, where the coal is all undercut by machines. Two sticks of powder is their maximum charge limit. In the Blockton field we have a maximum charge limit of three sticks. The coal there is a domestic coal, and we have tried every brand of permissible in that seam, but found none that will give results. The reason is that it is a hard, firm coal and the permissible powder is too quick in its action.

We never allow a man to take more than five pounds of powder into the mine at any time. We have a "Powder Jack" system and use a can with a screw top. These cans are turned in at the Jack House each night and filled with powder. The penalty for violating this rule is dis-

charge, and no excuses are taken at all. Mr. Scollard's statement that, in Indiana, they have a law that permits a man to use 6 lb. of powder in one shot amused me. In Alabama we have a law that says the charge of powder shall in no case exceed one-half the length of the hole. If the hole is three feet in length, there cannot be over 18 in. of powder charged in that hole. In some of our mines we permit the men to shoot when they please, and after becoming accustomed to the system they prefer to fire the small shots rather than the heavy ones, as they find they can break the coal better and get a larger tonnage.

Personally, I believe that black powder can be used in coal mines just as safely as permissibles, under proper regulation. The only reason I advocate the use of permissibles is, that an accident is not so likely to occur with the careless use of permissibles as with the careless use of black powder. It is the careless use of these explosives that causes accidents.

Mr. Back—We also have a law in Illinois that limits the amount of powder charged in a single hole, but in some places they exceed the limit of the law, yet you cannot catch them at it. A charge of 50 or 60 in. is the limit in our high seams. I think there are places, however, where they get about two shots out of a keg of powder.

Mr. Scollard—Mr. Flynn is certainly fortunate in having men he can control. In Indiana we think we are lucky if we can enforce the law. For instance, an operator will take no interest whatever in ascertaining how much powder is used in a hole. The more powder he sells the better he is satisfied. We need a law to regulate the amount of powder that a man can take into the mine. At times a man will take in two kegs at once, when they are working as "buddies," and it is hard to keep them from overloading their holes.

Some time ago, I filed a suit against parties owing to a man being injured by shots they had fired while he was working in the mine. I am sorry to say the miners' organization hired an attorney to defend the parties firing the shots and they won the case. The grounds on which I filed suit were based on a clause in the mining law that gives the inspector power to recommend safety measures

other than those prescribed in the statute; but the court dismissed the case, because no penalty was prescribed in the act.

Mr. Flynn—The charge limits I mentioned are fixed by the rules of the company, the officials and the mine inspectors. If these rules are violated promiscuously the mine foreman, his assistants or the underground safety inspectors may lose their job. Of course, the mine inspectors could not enforce these rules without the coöperation of the company.

Mr. Graham (*British Columbia*)—In the coal mines of British Columbia, we are using permissible explosives exclusively. No black powder has been used in the coal mines of the province during the past twelve years. Prior to 1913 all coal was produced by a low-grade dynamite. In 1913, a permitted list was published and all mines worked with safety lamps must use permissible explosives under that list. In 1915, a new permitted list was issued, and now nothing but permissible explosives are used in any coal mine of any character, in British Columbia. No person is permitted to take more than four pounds of powder into a mine at one time and all shotholes are examined, tamped and fired by a competent certificated shotlighter.

I think that, during the year 1915, the average amount of powder used per shot, in the coal mines of our province, was slightly under one-half pound.

Mr. Nesbitt—I want to correct the statement I made a few moments ago that in some instances 2 lb. of permissible explosives was the charge in some districts in Alabama. If I remember rightly, the charge limit on all permitted explosives, prescribed by the Bureau of Mines, is 1½ lb. I believe that the minute you exceed the charge limit of a permissible explosive, it ceases to be a "permissible explosive."

Mr. Graham—In British Columbia the charge limit varies, I think, in some instances from 10 to 28 oz. Permissible explosives are used in all rockwork.

I cannot indorse the statement made by Mr. Flynn to the effect that if black powder is properly handled it is as safe as permissible explosives. In my opinion, to accept

that statement would be to disregard the investigations that have been conducted, both in the United States and Great Britain. In every instance where research work has been in progress, it has been found that black powder is the dangerous element in coal mines. I believe the day is not far distant when no black powder will be permitted in any coal mine, both in Europe and in this country. If the researches of our various governments in respect to the use of explosives are to be of value to the mining industry, then we as inspectors and men imbued with the idea of safety must endeavor to promote the use of permissible explosives.

MR. FLYNN—Replying to Mr. Graham's comments on research work and experiments in respect to the use of black powder and permissible explosives, the conditions have always been made such as to produce the desired results in those tests. For instance, to show the effect of black powder on coal dust in a very dusty colliery, the necessary amount of dust is arranged in the gallery and a charge of black powder fired into it, which we know will ignite the dust. In other words, the conditions are made ideal for the test intended.

I concur with Mr. Graham in regard to the superior safety of permissibles as shown, where the conditions are arranged with the intention of making an explosion with one powder, when it will not occur with the other. If you give black powder the chance to break the coal, it will perform its work safely when the proper charge is used. I am not discussing safety-lamp mines, because we have none such in Alabama. All our mines are open-light mines, and in those mines I am sure that black powder can be used with as much safety as permissibles.

In the Blockton field, we use black powder, although it is a dangerous operation, owing to the faulty roof; but we have fewer accidents there than in any other field. We have not had, in that group of mines, what is known as a "windy" or "blownout" shot. For that reason, I made the statement I did, that under proper regulations and proper charge limit black powder can be used with as much safety as permissible powder. I still contend that can be done.

Where permissibles are used in blasting the roof we have more falls of rock and the roof cuts higher than where black powder is used. If I were operating a mine myself in the Birmingham district or in the Blockton district, not a pound of permissibles would be used. In the Blockton field, where we have used permissible powder, the powder cut up into the rock as far as it could break. Then, the air gets in and the rock begins to dry out and fall, which gives us any amount of trouble. We could go into headings, in this field, where rock had been blasted by black powder before permissibles were introduced, and it was just as firm as ever. So that I am forced to conclude that permissible explosives have their disadvantages as well as advantages. In my opinion, the chief object in using permissibles is to prevent explosions of gas and dust. I regard them more dangerous in our mines than black powder, because they affect the roof, the explosion being more violent.

Mr. Graham—In respect to the question of safety between the two explosives, I am pleased to know Mr. Flynn has conceded the point that, under similar conditions, even though prepared for the purpose of demonstration, black powder will ignite gas and dust where permissibles will not, and I am satisfied to let it rest there and say that permissible explosives are the safer of the two for mine use.

The President—I see that one of the subjects announced on the program prepared by our secretary is "The Coal Mines of Missouri," the discussion to be opened by George Hill, chief mine inspector of Missouri. We shall be glad to hear from Mr. Hill.

The Coal Mines of Missouri

Mr. Hill (*Missouri*)—The coal-bearing portions of Missouri can be divided into two fields, the higher coal fields being in Macon and Randolph Counties, and the lower coal fields in Lafayette County, along the Lexington Branch.

The higher coal fields of this state have a cover varying from 20 to 125 and 150 ft. in depth, the seam being regularly about 4½ ft. high. The larger operations are worked

on the room-and-pillar plan, similar to that used in most all large mines. The ventilation is generally produced by a 12-ft. fan, which will furnish from 100,000 to 150,000 cu.ft. of air per minute against a water gage of say 1½ in.

The larger mines employ about 250 men. The mining laws of Missouri require a circulation of 100 cu.ft. of air per man per minute. The largest mines produce from 1,000 to 1,500 tons of coal per day.

The laws of the State of Missouri on shotfiring, provide that there shall be employed one shotfirer for every fifty miners; so that 5 shotfirers would be required in a mine employing 250 men. Where the coal is shot from the solid or where gas is found in mines, the law specifies that no shots shall be fired till the men have all retired from the mine.

The high seams are overlaid with a very poor roof, yet we have comparatively few accidents. I believe that to this date we have mined approximately 2½ million tons of coal with but two fatal accidents. Last year we mined about 7 million tons of coal and I think our accident rate was about 1½ per thousand men employed in the mines. We usually get through the year with about one fatality for every thousand men employed, and that is a good showing, considering the poor roof conditions.

The worst feature in respect to roof conditions is, that where there is a stretch of pretty fair roof one can generally look for an accident to happen. Where the roof is poor the men are always watching; but I usually warn the boys not to get careless when I find them working under a fair roof.

In the low-coal fields of Missouri, near the Lexington and Richmond Branch, we have a seam of coal that varies from 22 to 28 in. high. The roof is fine and could not have been better. The solid top is overlaid with limestone, while the floor is a very soft fireclay. The coal is mined with machines and from 500 to 800 tons are produced per day. Practically no timber is used and the conditions are ideal. Ventilation is carried on the same as in other large mines.

I want to call attention to one requirement of the laws of Missouri, which permits only fifty men to work on a single current of air.

Mr. Scollard (*Indiana*)—Who pays the shotfirers in this state?

Mr. Hill—The companies pay them.

Mr. Nesbitt (*Alabama*)—How far is the back wall kept from the face?

Mr. Hill—I judge about four feet.

Mr. Dunlop (*Illinois*)—How thick is the coal?

Mr. Hill—The seams vary from 2 to 5 ft. in thickness.

Mr. Rutledge (*Illinois*)—In comparing the conditions in different mines, it is necessary to use much caution before making a statement. I know something of the mines Mr. Flynn has mentioned and can say that they are most unpromising. In our Oklahoma mines, conditions are bad. I don't think there is a superintendent or mine foreman in McAlester that goes to bed before nine or ten o'clock, for the reason that we have so many shotfirers' accidents, due to the use of black powder. I know of one little cemetery where twenty-six shotfirers are buried. A few years ago the mine in that place was put on a machine basis and has used permissible explosives ever since. I believe it is the safest mine to operate in that part of the country.

There is a practice they have in Oklahoma of shooting what are called "cracker shots." Men that I have interviewed in other places almost invariably tell me they would not think of shooting one of those "cracker shots." Many would not think of using black powder, but use permissibles instead. About four years ago Chief Mine Inspector Boyle and myself were called to an explosion—a most disastrous one—where 73 men, I think, were killed. That mine has now been operating for six or seven months using machines and permissible explosives and they have no trouble.

We have two mines in the Crebs field where the manager himself told me that his last explosion cost him $20,000, paid to settle law suits. Part of the mine has not yet been recovered, although they have been working constantly to recover the entire mine. The accident was caused by the use of black powder. From where I took the train to come to this convention I could see a mine that was operated for three years, but has not been worked since the last shotfirer

was killed. A black-powder accident put that company out of existence.

I was glad to hear Mr. Graham speak as he did about the limit of charge. I think I can safely say that everything being equal, permissible explosives will cause you less trouble in a mine than black powder.

Mr. Flynn (*Alabama*)—I do not place too much confidence in permissible explosives, because our manager decided that, as we were using permissible explosives in that mine there was no use in making fireruns. We cut off the firerunners to reduce expenses and a short time after an aircourse was discovered on fire, which cost the company considerable money to extinguish. It was then decided that permissible explosives are not an absolute protection against mine fires.

Mr. Boyle (*Oklahoma*)—In the Oklahoma mines we have used permissible powders for about seven or eight years, but to a limited extent only, until the last two years. For the past two years the statistics and reports in my office will show that about 85 per cent. of the fatal accidents in Oklahoma mines are attributable to other causes than explosions, mostly falls of rock and moving cars. When black powder was being used from 60 to 75 per cent. of the accidents were due to explosions.

I worked in the McCurtin field above five years. When I went there nothing was used except black powder, except that when a place was struck that was hard to cut, they would permit the use of dynamite. The fires became so disastrous, however, that the company issued an order compelling the use of dynamite, which ended the fires to a great extent. We do not claim that permissibles give immunity from mine fires, for at times mines are generating gas and a bad shot starts a fire.

In a McCurtin mine where I was firebossing at the time, I asked a man who was hauling water for sprinkling to run the mine that night for fire. Soon after going on my rounds to another part of the mine, I heard an explosion of gas and decided it must have come from the entry where I left the man. Turning back at once, I found the man as I had expected. In answer to my question in regard to the explosion, he stated that he had lighted

some gas by holding his head too high in the place. Detecting a slight smell of fire, I went further into the entry and found a small gas feeder still burning in the coal. I am convinced that many firerunners start fires in the mine just in this way. They should not be allowed to run the mine with open lights.

As Doctor Rutledge has said, that mine blew up four years ago, killing 73 men. It was the ninth explosion that had occurred in that mine, and each time the disaster was complete. While working there I never went home a night without expecting to be called to the mine later in the evening on account of fire, either in No. 2 or No. 3 mine. But, since permissibles have been used in that field, they are not bothered with fires.

If I had my say, no powders other than permissibles would be used in any mine in the United States. They are giving good results in our mines, and there is no desire to abandon their use. Anything that adds to the safety of life and property in mining should be adopted, even if it is the means of saving but one life in a year. There will always be a difference of opinion between mining men, in regard to the causes and prevention of accidents.

The question today is: Has the progress that we claim to have made in regard to safety resulted in making the mining business less hazardous than it was 25 years ago? If what has been accomplished along this line is to be cast to the winds I say there is something wrong. We must study the facts as they are presented to us, find out the remedy and put it in practice in the mine. Every mine inspector here would learn with deep regret of a disaster in his district today that had snuffed out a few dozen lives, and yet it is possible that such may occur any moment. Have we failed, then, in our research work? I have no axe to grind, no friends to reward, or enemies to punish, but I say when mining men such as assemble here decide that certain things are wrong, we must abide by that decision. Otherwise, we might as well go home never to meet again as an Institute.

The mine inspectors assembled here have the most important work to perform of any class of men under the shining sun. We must understand that the lives of the

men who work underground are largely in our hands and that we are responsible for the conditions under which they are compelled to work day in and day out. If we violate our duty, as we understand it and as the law provides, we are unworthy of the confidence of our people. We owe to them the faithful performance of the duties of our office. It is my hope that we will go away from this meeting inspired with a determination to perform our whole duty and reduce the accident rate in the mines in our jurisdiction.

Mr. Flynn—I don't want anyone to go from here with the idea that I am opposed to the use of permissibles. My contention is that in our coal fields in Alabama we gave them a fair trial. We invited explosive experts operating other mines, and various powder companies to show us how a permissible powder would give us the same results as black powder. These efforts, however, proved of no avail. I readily grant that the reckless use of a permissible powder is not as liable to cause an accident as the reckless use of black powder. My contention is that, under strict regulations in Alabama, we can use black powder as safely as permissibles.

In Oklahoma, where I got much of my mining experience, all the accidents in the mines were caused by the use of black powder. I call to mind an accident of this kind that occurred in March, 1915, in which four men were killed and four escaped alive; God knows how many pounds of powder were used in that hole.

Mr. Boyle—The accidents due to explosions of powder, in Oklahoma mines, have been reduced 75 per cent. by the use of permissible powders.

Mr. Pellegrino (*Kansas*)—The systems of mining employed in our state are the longwall and the room-and-pillar systems. There are over 100 deep mines and 22 steam-shovel mines in Carter and Cherokee Counties. Nothing but black powder is used, except that dynamite is employed where "horsebacks" are encountered. Shotfirers are employed in the mines. They fire once a day and only after all the men have gone out of the mine.

The electric firing system is used in three mines in my district; these are No. 7 McCormick, No. 8 Hamilton

and No. 2 Cady. There has been much trouble in these mines from explosions caused by blasting. McCormick No. 7 blew up so often that they ceased to tell the number of times. Cady No. 2 blew up five times, and, in Hamilton No. 8, the miners forced them to take out the wires and employ shotfirers. However, a little later, the mine blew up, killing a shotfirer, and the miners consented to the use, again, of electric firing.

Last year our mines produced 6,800,000 tons of coal, with 24 fatal accidents. In 1900, 4,300,000 tons of coal were produced, with 20 fatal accidents. Last year the fatal-accident rate was reduced 33 per cent., which I consider is a remarkably good showing.

In the Osage field, the coal is from 18 to 24 in. high, while at Pleasanton it is 3 ft. thick. In both districts the longwall system is used. In places the cover overlying the seam is light and the first mining done was strip mining, about 35 years ago. Last year these mines produced 400,000 tons, while in 1915 they produced 600,000 tons. By the use of steam shovels, these workings may produce 1,000,000 tons next year.

In my district, 10 shotfirers were killed in 24 mine accidents, and we only lost three men by gas explosions while acting as firebosses, and two from the same cause while mining coal at the face. The mines are worked with open lights. In mine No. 18 a miner ignited some gas while putting away his tools. Within 200 ft. of the place there were five men making up powder charges. Two of these were killed, two others burned and their legs broken, while one escaped without injury.

The men order a 25-lb. keg of powder at a time, and this is delivered to each miner at his switch, by the company. A miner usually produces 1,300 tons of coal with a single keg of powder in the mine, while in strip mines the same powder will produce 60 tons of coal. Last year an attempt was made by the Hercules Powder Co. to have the strip mines use permissible powder, but the miners were absolutely opposed to it, claiming that it required too much shoveling. These miners are paid by the day. I will say that the Mining Department and the coal operators are working hand in hand.

Mr. Reid (*Illinois*)—This question of powder comes home to me in my district, and I agree with Mr. Flynn that we should not be too sure in regard to the use of permissibles under different mining conditions. Practically all the mines in my district use black powder. Some mines use as high as 35 kegs a day—others 60 kegs. I understand that they use nothing but permissibles in the 11th Inspection District in our state, but there were 48 fatalities in that district and 12 in an adjoining district where permissibles were used. Neither operators nor miners in my district favor the use of permissibles for several reasons, claiming that they do not produce a good quality of coal and increase the labor of the miner.

We must agree that it is not always possible to change conditions to suit the miner, the operator and the inspector. It is the custom in our state to refer such a question as powder to a commission appointed to test the matter, and it may transpire that the fault is not altogether with the powder. Where black powder is used under strict regulations, I do not believe it would be condemned as severely as has been the case. Of course, the handling of black powder is more dangerous than the handling of permissibles.

When visiting mines in the 12th district I have observed as many as 118 and, in one instance, 150 places marked for gas that morning, and yet they use black powder and work with open lights in that district. It is my opinion that if the ventilation in a mine is good and other conditions favorable the danger in the use of black powder will be much less than it is at present. For example, there are three mines in the district I last mentioned that are kept absolutely clean, the operators doing more than what the Illinois law requires. One of these mines works about 500 men, while the other two work 330 or 340 men each. In a district adjoining this one, they use permissible powders altogether, and yet have a great many accidents. I conclude, therefore, that the accident rate does not depend wholly on the powder used.

The President—If there is no further discussion on this question, I will ask Mr. Bartlett to read his paper

relating to mining conditions in Ontario, having special reference to safety work in the mines.

SAFETY WORK IN ONTARIO MINES

By James Bartlett*

The mineral production of Ontario in 1915 was valued at $61,800,000, or 44.6 per cent. of the total for the Dominion of Canada. The principal products were: Nickel, 34,000 tons; copper, 20,000 tons; silver, 23,700,000 oz.; gold, 411,000 oz. In addition iron pyrites, iron ore, feldspar, talc, graphite and mica were mined in the province. The dividends from Ontario metal mines last year amounted to $20,000,000. The mineral possibilities are now being recognized and the mining industry is expanding very rapidly.

The most important areas are: The Sudbury nickel area, the Cobalt silver area and the Porcupine gold area. Sudbury is the world's principal source of nickel and over 70,000,000 tons of nickel ore have been proved with a considerable portion of the ranges still unprospected. The chief inspector of mines recently estimated that the prospected part of the field contains, in addition to the nickel, at least two billion pounds of copper and $60,000,000 worth of gold, silver, platinum and palladium.

Sufficient evidence has been gathered in recent years by statisticians to prove that the accident rate in metal mines is higher than in coal mines. Formerly it was generally believed that the reverse was the case. The fatal accident rate in Ontario for the last 15 years averages 3.18 per thousand men employed. Last year it was 1.51 and was the lowest of which there is any record in Ontario mines. A perusal of the statistics of the province for the last four years shows that the fatal accidents may be classified as follows: Those due to explosives, 28 per cent.; shaft accidents, 24 per cent.; miscellaneous causes, 21 per cent., which covers such accidents as falling down winzes or stopes; struck or buried by ore; crushed between cars; struck by falling objects, etc.; surface accidents, 19 per cent.; and falls of ground, 8 per cent.

The percentage of accidents due to explosives is very high as compared with other countries where reliable

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statistics are available. It is difficult to guard against accidents from this cause and to explain why they should form so large a percentage. The cold weather in the winter months is no doubt responsible for many accidents.

The standardization and testing of explosives by the Dominion Government would probably help matters. A testing station for this purpose has been advocated for some years, but has not yet materialized. In the last two years the use of No. 8 detonators has become quite general underground, and as a result there are fewer unexploded sticks of dynamite left in the bottoms of holes than formerly. Gelatin dynamite has become the most popular explosive, and the number of cases of asphyxiation is considerably less than with the old-time straight nitroglycerin dynamite.

Inspection of Ontario mines began in 1890 and most of the clauses of the Mining Act of Ontario have been passed since that date. The inspection staff at present consists of a chief inspector and three deputy inspectors. I will mention a few points in the Act, hoping it may arouse some discussion.

Inquests—An inquest is compulsory in case of a fatality in or about a mine, and an inspector invariably attends. This frequently interferes with the inspector's routine work, but is nevertheless an important clause in the Act. Everyone dislikes inquests, with the possible exception of the coroners, who receive good fees by way of consolation. Mine officials in particular dislike attending these functions. If an inspector were not present to examine the witnesses it is quite likely that the facts would not be brought out, as the coroner is generally unfamiliar with mining practice and it frequently happens that there is no one on the jury who has any knowledge of mining. Also, the inspector gains a great deal of information which is useful in devising means to prevent the repetition of similar accidents, and he often learns, while examining men under oath, of unsafe practices that would not otherwise be brought to his notice.

Ventilation—While this is the most important subject in connection with the working of collieries, it unfortu-

nately receives too little attention in the average metal mine. If ventilation were more closely studied by metal-mine operators the results obtained, owing to the improved health and efficiency of the workmen, would well repay them for the effort.

Storage, Thawing and Use of Explosives—The maintenance of a storage magazine within 400 ft. of the mine, works, or any public highway is forbidden. In the draft of laws recommended by the commission who were appointed to investigate the subject of mining regulations for the U. S. Bureau of Mines, 300 ft. is the specified limit. In the case of some of the larger mines these distances are undoubtedly insufficient. One Ontario mine is at present using 2½ tons of gelatin dynamite per day. This problem of storing large quantities of explosives is one with which we are frequently confronted, but it is doubtful if the question can be satisfactorily dealt with by legislation. Climatic and topographic conditions, the quantity of explosive used and the discipline on each particular property are important factors. If thawing houses be placed too far away from the shaft, dynamite may in the coldest weather enter the mine in a frozen condition. In some cases underground thawing rooms are used and occasionally the question arises in the case of large mines whether such rooms, containing large quantities of explosive, should be permitted underground or not. In a warmer climate the explosive risk is not so great.

A reliable recording thermometer must be placed in the room in which the thawing is done and a temperature record kept. The use of such a thermometer enables the superintendent to keep a close check on the temperature of the thawing house and in a number of cases overheating to the danger point was discovered, whereas nothing of the kind was suspected before this type of thermometer was put in use.

Another clause of the Act forbids drilling in a working place where there are missed holes.

Protection of Working Places—In shaft sinking a pentice of rock, timber, iron or steel must be provided if any material is being hoisted in the same shaft from any

of the upper levels. Such covering has to be sufficiently strong to withstand the shock of the loaded bucket, skip or cage falling from the highest point in the shaft. This regulation has saved many lives.

Timbering—In Ontario there is no swelling ground. The rock is for the most part hard and stands well. Methods are used which require a minimum amount of timber in the stopes. Overhead shrinkage stoping is general in the large ore bodies.

Ladderways—In shafts or winzes the ladderway must be separated by a closely boarded partition from the hoisting compartment. Ladderways are required to have platforms at intervals of not more than 20 ft. and ladders must not be set in a vertical position.

Shaft Appliances—All cages in which men are handled must be constructed with a hood of steel plate not less than $\frac{3}{16}$ in. thick, with sides covered with $\frac{1}{8}$-in. sheet iron or steel or wire netting, and with gates 5 ft. high. This regulation was put into force Jan. 1, 1915, and is working well. We are glad to be rid of the old skeleton cage, which was still in use at a few mines. At first some trouble was experienced in getting a suitable gate that could be easily opened and closed but could not be sprung outward by pressure from within. This difficulty, however, was soon overcome.

Escapements—When a shaft has been sunk more than 100 ft. and 200 ft. or more of drifting done and stoping started, in addition to the hoisting shaft, a separate escapement shaft or opening must be provided.

Protection from Machinery—Under this heading are the usual rules relating to guard rails, projecting set-screws, inspection of boilers, etc. It is regrettable that the manufacturer cannot be compelled by law to attach such necessary safeguards as gear casings, etc., to machinery before shipment is made from the factory. Quite often it is necessary to compel the purchaser to have this done with new machinery and often he is in an out-of-the-way place, where the facilities for doing such work are not the best.

Prevention of Dust—As the work of commissions in different parts of the world has proved that working in a

dusty atmosphere affects the lung tissues, the subject is of especial interest to mine inspectors. Medical men have in some cases taken exception to the terms "miners' consumption" and "miners' phthisis" and designate the disease or condition caused by the dust by the name "fibrosis." But by whatever name it be known, cases of the disease are to be found in nearly every metalliferous camp, especially since machine mining has been in vogue. The subject has been dealt with by able investigators in the Transvaal, in West Australia, in the Rand and recently in Missouri. All agree in attributing the disease to dust, poor ventilation and the consequent breathing of dynamite fumes and vitiated air, all of which exert a harmful influence. While individual opinion on a question of this nature may be of doubtful value, it has often occurred to the writer that the scarcity of men of over 45 yr. of age in metal mines is largely due to such cause. This does not seem to be so noticeable in colliery towns as coal dust is not so injurious in that respect.

Since the Porcupine gold district was discovered in 1909, gold mining has become one of our important industries. Three of the mines already have each got over $16,000,000 worth of ore reserves developed above the 700-ft. levels. Besides these there are many other smaller but important producers. The ores are largely siliceous and the question of dust prevention is, therefore, important. One of the chief causes of dust is the drilling of dry holes with the hammer drill. Spraying attachments, working on the injector principle, were tried, but it was found that most of the miners would not use them. In several of the large mines the method of stoping has been modified so that chiefly wet holes are drilled. The increased use of the Leyner-type of drill is helping to solve the problem in certain kinds of ground and is doing good work, particularly in drifting. The Hollinger gold mine is at present experimenting with hammer stoping drills with telescopic feed, hollow steel and water attachment and report favorable results to date.

Workmen's Compensation—At the close of 1915 a Workmen's Compensation Act had been in force in Ontario for one year. By its terms compensation is payable

irrespective of any question of negligence or absence of negligence, and the old defences of common employment and voluntary assumption of risk are no longer applicable. The only cases in which no compensation is paid are: 1. Where disability lasts less than seven days. 2. Where accident is solely due to serious and wilful misconduct on the part of the workman and does not result in death or serious disablement.

For an accident resulting in death the payment is $20 per month and $5 for each child under 16 yr. of age up to a total of $40. In no case is the compensation to exceed 55 per cent. of the workman's earnings. In case of total disability the workman receives 55 per cent. of his earnings in the employment. Where the workman is only partially disabled he is entitled to 55 per cent. of the impairment of his earning capacity.

Prior to the operation of the Compensation Act most of the larger companies insured themselves in a casualty company against damages for accident. If the accident rate became abnormally high at any mine the insurance company increased the rate of insurance, sometimes doubling the rate on very short notice. This generally resulted in a storm about the works of the offending company and a genuine effort was made to reduce the accident rate. This incentive is not now in existence to the same extent as the assessments from all mining companies are paid into a common fund. Several of the companies which had safety organizations before the Compensation Act came into force have since allowed them to expire. The Compensation Act, therefore, while an excellent piece of advanced legislation, has not assisted mine inspectors in improving mining conditions.

THE SECRETARY—I am sorry that we have not more time to show our appreciation of Mr. Bartlett's paper by discussing its many points of interest. I feel sure that all of us have enjoyed the reading of this paper and wish to move a vote of thanks to its author.

The motion extending a vote of thanks to Mr. Bartlett for his valuable paper being seconded by Mr. Boyle was passed by a unanimous vote.

THE PRESIDENT—Our time is short, but I am going to ask Mr. Holland to speak for a few moments on the question of Ventilation at the Time of Shooting in Iowa Mines.

MR. HOLLAND (*Iowa*)—The question of maintaining or reducing the circulation of air in our mines at the time of firing has always caused much controversy. I am afraid its suggestion here will provoke as much discussion as the question of The Use of Permissible Powders in Mines, to which we have listened with much interest. The discussion reminded me of a story told of the manager of a powder mill who found it necessary to request a number of visitors who desired to be shown through the place, to first throw away their cigars. They did not appreciate the conditions they were about to face. The same may be true in regard to the question of stopping the ventilating fan at firing time, which is largely a question of conditions prevailing in the mine.

In the first place, I want to ask, Why stop the fan at firing time? The answer to that question is, So as to reduce the circulation and prevent the occurrence of dust explosions that are liable to follow the firing of shots.

There are three factors that enter very prominently into every dust explosion in mines; namely, solid shooting, dust suspended in the air, and a liberal supply of oxygen. The argument is advanced that, with the reduction or removal of one or more of these factors, the liability of an explosion occurring is reduced in that proportion. Now, as we all know, the great danger of solid shooting is the tendency of the miner to drill his hole to a depth that the charge of powder has no opportunity to perform its work. Again, many miners have the habit of placing one shot behind another, thus making the second shot dependent on the first, which must execute its work before the second charge explodes. Too many shots are fired in a tight place, causing a blownout or a windy shot, with the result that much fine dust is blown into the air and may be ignited by the flame of the succeeding shot and cause a local explosion of dust.

But, as oxygen is necessary to combustion and flame can neither be kindled nor propagated without a sufficient

supply of that element, it seems only reasonable to conclude that the less oxygen there is in a mine at the time of firing, the less danger there will be for the ignition of dust and the propagation of flame throughout the airways and the mine. However, I believe there are limitations to this practice.

There is, in my district at the present time, a mine advanced so far that the firing of shots produces a large amount of carbon dioxide, filling the workings with blackdamp to such an extent that I have found it necessary to order them to run the fan slowly when firing. Without doing this, it was impossible to keep the mine clear of blackdamp.

I want to cite a case that, if Mr. Beard was present, he would probably recall, as he was mining engineer for the company at the time the incident I am about to narrate occurred. I believe it was in the year 1887, that the workings in mine No. 2 of the Whitebreast Fuel Co. had advanced so far underground that it was impossible to get the necessary ventilation in the workings. In order to furnish more air in the mine, it was decided to sink another shaft nearer the working face and move the fan to that location.

Prior to that time, the miners fired their own shots, and there were no windy shots reported; but, immediately following the sinking of the new shaft and for two years thereafter, especially in the winter time, it was a common thing for small dust explosions to occur and men were carried out of the mine seriously burned. It was not then known what was the real cause of the trouble.

Allow me to cite another instance that occurred in my district about two years ago. A new mine had been opened, which I wished to safeguard by every possible precaution. I recommended the loading out of all drill dust and the sprinkling of all roads and passageways. I also asked them to cut a refuge hole in the solid coal for the shotfirer. This refuge hole was to be closed by a heavy door, and the shotfirer was instructed to light only a few shots at a time and retire to this place of refuge and wait until all the shots had gone off.

For a time, everything went well; but one night there were two shots to be fired that the shotfirer had not the

courage to refuse to light, as the law allowed, although he regarded them unsafe. One of these holes started 6 in. from the bottom and was 5½ ft. deep, while the second hole, just above that one, was 6½ ft. deep. The bottom shot went off first but did little more than raise the dust, which was blown into the air. The heat and dust of the first shot made conditions fine for a dust explosion when the second shot went off. The result was as violent an explosion as I ever knew.

One of the cages in the hoisting shaft was blown 75 ft. to the top of the shaft, while the other cage at the upper landing was blown entirely out of the shaft carrying with it the sheave wheel. Every step in the manway, provided for the escape of men, was blown from the shaft. In this explosion the flame traveled 600 ft. The shotfirer had barricaded himself in the refuge hole and braced the door with a timber or plank 3x10 in. and 8 ft. long. The pressure was so great on the door that the timber was broken, but the shotfirer escaped injury and, going to the hoisting shaft, was hoisted soon after by a rope lowered from the surface. To my mind this and similar accidents are sufficient proof that too much oxygen in the mine air at the time of firing is dangerous.

THE PRESIDENT—Mr. Graham has kindly consented to give us a few remarks on the Inspection System in the Province of British Columbia.

MR. GRAHAM (*British Columbia*)—Inspection in British Columbia dates back to 1887, when the first Coal-Mines Regulation Act was placed on the statute. That act followed the trend of the legislation then in existence in Great Britain. All the amendments and provisions of the British Columbia Act have also followed the trend of British legislation. At the time this act was enacted coal mining was confined exclusively to Vancouver and local mining was not in existence. The first inspector appointed under the Coal-Mines Regulation Act was E. G. Bryer, of Victoria, who afterward became prime minister to our province. In 1897, two inspectors were appointed. The inspection service at the present time consists of a chief inspector and a deputy, for coal and metal mines.

The powers and duties of the inspectors are probably better defined by the written provisions of the act than I could explain in a brief talk.

Extracts from the Coal Mines Regulation Act

INSPECTION OF MINES

Appointment of Inspectors

ARTICLE VII

Sec. 71. The lieutenant governor in Council may from time to time appoint fit persons, who must be possessed of mine managers' certificates of competency, to be inspectors of mines, and assign them their districts and duties, and may award them such remuneration as the lieutenant governor in Council may approve, and may remove such inspectors.

Sec. 72. The minister may designate one of such inspectors as chief inspector, and assign to him such duties and designate any such place as the office of such chief inspector as he may see fit.

Sec. 73. The minister may at any time appoint any mining engineer or other person of scientific or special attainment or practical experience to make a special investigation and report upon any mining operations so far as they relate to the safety of life and property in any mine, and such person so appointed shall have all the rights of entry into such mine and access to such plans and records as are accorded to an inspector under this act; and in such case the minister may cause such report to be made public at such time and in such manner as he thinks expedient.

Sec. 74. Notice of the appointment of every such inspector shall be published in the Gazette.

Sec. 75. Any such inspector is referred to in this act as an inspector; and the inspector for a district means the inspector who is for the time being assigned to the district or portion of the province with reference to which the term is used.

DISQUALIFICATION

Sec. 76. Any person who practices or acts, or is partner of any person who practices or acts, as a land agent or mining engineer, or as a manager, viewer, agent, or valuer of mines, or arbitrator in any difference arising between owners, agents, or managers of mines, or is otherwise employed in or about any mine (whether such mine is one to which this act applies or not), shall not act as an inspector under this act, and no inspector shall be a partner or have any interest, direct or indirect, in any mine in the district under his charge.

POWERS AND DUTIES OF INSPECTORS

Sec. 77. An inspector under this act shall have power to do all or any of the following things, namely:

(1) To make such examination and inquiry as may be necessary to ascertain whether the provisions of this act relating to matters above ground or underground are complied with:

(2) To enter, inspect, and examine any mine and every part thereof at all reasonable times by day and night, but so as not to impede or obstruct the working of the said mine, except in an effort to save human life:

(3) To examine into and make inquiry respecting the state and condition of any mine or any part thereof, and the ventilation of the mine, and the sufficiency of the special rules for the time being in force in the mine, and all matters and things connected with or relating to the safety of the persons employed in or about the mine or any mine contiguous thereto:

(4) To exercise such other powers as may be necessary for carrying this act into effect.

The inspector shall visit every mine within his jurisdiction and every part thereof, and all underground traveling-roads leading to and therefrom, and all aircourses, at least once every month.

Immediately after each visit the inspector shall cause to be posted in some conspicuous place, at or near the mine, a statement showing what portion of such mine has been inspected, and the condition found to prevail therein; and he shall furnish a copy of such statement to the manager of such mine.

Sec. 78. Every person who willfully obstructs any inspector in the execution of his duty under this act, and every owner, agent, or manager of a mine who refuses or neglects to furnish to the inspector the means necessary for making any entry, inspection, examination, or inquiry under this act in relation to such mine, shall be guilty of an offence against this act.

Sec. 79. (1) If an inspector, upon careful investigation, is of the opinion that a mine or any part thereof is in any respect dangerous, or that any matter, thing, or practice done, followed, or permitted in, about, or in connection with such mine constitutes a defect calculated to impair the efficiency of mining operations or to endanger the safety of any person in or about such mine, such inspector shall give notice thereof in writing to the owner, agent, or manager of the mine, stating in such notice the grounds of his opinion, and shall, by the said notice or otherwise, order that such remedies be applied and such provision be made for the safeguarding of those employed in or about the mine as he thinks requisite. If the inspector is of the opinion that any delay in remedying such matter would be dangerous, he may order the closing of the mine or any part thereof, or may order the stopping of all work therein or connected therewith, until the matter complained of be remedied; and in every such case the inspector shall forthwith transmit to the minister a copy of the order and a full report of the reasons therefor.

Any owner, agent, manager or other person refusing or neglecting to obey any order given by the inspector under this subsection shall be guilty of an offence against this act.

(2) Where an inspector has reason to believe that a dangerous condition exists in any mine by reason of the approach of workings to old or abandoned workings, he shall

at once report to the chief inspector, who in turn shall report to the minister. Under instructions from the minister the chief inspector shall make an examination of the locality in which such workings are situated, and issue directions to govern mining operations (if any) to be carried on in such locality until such dangerous condition is removed or overcome.

(3) The powers and duties of the inspector under this section shall also extend to the case of the employment in a mine of any person who, by want of understanding, knowledge or skill, or owing to mental or physical incapacity or incompetency for the performance of the particular task or duty upon which he is engaged, or who from any cause is unable to clearly understand instructions conveyed to him, or is or may be a source of danger to any other person in the mine in which such person is for the time being employed, or whose presence or employment in such mine exposes or may expose any person to the risk of bodily injury; and and it shall be the duty of the inspector, on the application in writing of any three miners employed within his inspectorate or on his own initiative, to examine any person or persons employed in such mine, for the purpose of ascertaining whether any such want of understanding, knowledge, or skill, or any such mental, physical, or other incapacity or incompetency or inability to understand instructions, exists on the part of any person or persons so employed; and the employment in any mine of any person in whom such want of understanding or skill, or such mental, physical, or other incapacity or incompentency exists, or is found by the inspector to exist, shall be deemed to be a matter, thing, or practice within the meaning of this Act constituting a defect calculated to impair the efficiency of mining operations and to endanger the safety of persons employed in or about such mine, and an inspector may order the removal of any such person from such mine, and upon an inspector making such order such person shall be immediately removed from the mine.

Sec. 80. An inspector ordering the removal of such person as aforesaid from a mine shall forthwith give notice of such order to the owner, agent, or manager of the mine, and any owner, agent, or manager who continues after receipt of such notice to employ such person in or about the mine shall be guilty of an offence against this act.

Sec. 81. If the owner, agent, or manager of the mine objects to any order of an inspector under either of the last two preceding sections, he may, within twenty-one days after receipt of the notice of such order, send his objection in writing, stating the ground thereof, to the minister; and thereupon the matter shall be settled by arbitration in the manner provided by this act, save and except that in such arbitration the parties to such arbitration shall be the owner, agent, or manager of the mine on the one hand, and an inspector (on behalf of the minister) on the other; and the date of the receipt of such objection shall be deemed to be the date of the reference.

Sec. 82. In case the award made on arbitration upholds the order of the inspector, and the owner, agent, or manager fails to comply with such award, he shall be guilty of an of-

fence against this act, and the notice and award shall respectively be deemed to be written notice of such offence.

Sec. 83. No person shall be precluded by any agreement from doing such acts as may be necessary to comply with the provisions of sections 78, 81 and 82 of this act, or be liable under any contract to any penalty or forfeiture for doing such acts.

The powers and duties of inspectors of metalliferous mines are different and read as follows:

INSPECTORS AND THEIR DUTIES

2. The lieutenant governor in Council may appoint an inspector or inspectors of metalliferous mines, and mines of whatever description other than mines to which the "Coal-Mines Regulation Act applies who shall be of at least seven years' practical experience in mining, whose duties shall be as hereinafter specified, and who shall receive such salary and allowances as shall be determined by the lieutenant governor in Council; and before entering upon the discharge of his or their duties he or they shall take and subscribe an oath that he or they will discharge such duties faithfully; the provincial mineralogist shall have the powers and may exercise the functions conferred on an inspector of metalliferous mines by this act.

3. The minister of mines shall, on receipt of reliable information relating to the health and safety of the workmen employed in any metalliferous mines in the province or whenever he deems such inspection necessary, instruct the inspector to examine and report to him the condition of such mine. The mine owner, agent, manager, or lessee respectively, shall have the right to appeal on any difference that may arise between them and the inspector to the minister of mines. On receipt of notice of any serious accident in any mine, the minister of mines shall instruct the inspector to inquire into the cause of such accident.

4. The inspector shall exercise a sound discretion in the advancement of the objects of this act, and in the enforcement of the regulations made hereunder; and if he shall find any matter, thing or practice in or connected with any metalliferous mines to be dangerous or defective, so as to, in his opinion, threaten or tend to the bodily injury of any person, the inspector shall forthwith give notice in writing thereof to the owner, agent, manager, or lessee, stating in such notice the particulars in which he considers such mine, part thereof, or practice to be dangerous or defective, and he shall order the same to be remedied.

5. It shall be the duty of the inspector to forthwith post up, or cause to be posted up, in a conspicuous place at the mouth of the mine, or at some other conspicuous place thereon, a copy of such notice in order that workmen in and about the said mine may become aware of the contents thereof.

6. The minister of mines shall instruct the inspector to examine and report to him—

(a) The condition of the hoisting machinery, engines, boilers, whims, cages, cars, buckets, ropes and cables in use in all the metalliferous mines in operation in the province:

(b) The appliances used for extinguishing fires:

(c) The manner and method of working and timbering the shafts, drifts, inclines, stopes, winzes, tunnels, and upraises through which persons pass while engaged in their daily labors:

(d) The condition of all exits from the mine.

(e) How the mine is ventilated, together with the sanitary conditions of the same:

(f) How and where all explosives and inflammable oils and supplies are stored:

(g) The system of signals used in the mines.

The inspector shall not give notice to any owner, agent, manager or lessee of the time when such inspection shall be made.

7. The inspector of mines shall not act as manager or agent or lessee for any mining or other corporation during the term of his office, but shall give his whole time and attention to the duties of the office to which he has been appointed; he shall not make a report on any mine or mining property for any person or persons interested in such mine or mining property, with intent to promote or aid in the sale or other conveyance thereof—and any officer violating this provision shall, upon summary conviction thereof, forfeit and pay a fine of not less than one hundred dollars nor more than one thousand dollars.

8. If the inspector shall reveal any information in regard to orebodies, chutes, or bodies of ore, or location, course, or character of underground workings, or give any information or opinion respecting any mine, obtained or formed by him in making such inspection, upon summary conviction thereof the said inspector shall be removed from office and fined in a sum not less than one hundred dollars nor more than one thousand dollars.

INSPECTOR'S REPORT

9. The inspector shall make an annual report of his proceedings during the preceding year to the minister of mines, which report shall be laid before the Legislative Assembly.

10. The minister of mines may at any time direct an inspector to make a special report with respect to any accident in a mine to which this act applies, which accident has caused loss of life or serious personal injury to any person; and in such case shall cause such report to be made public at such time and in such manner as he thinks expedient.

It will be noticed that an inspector of coal mines must be the holder of a first-class certificate of competency. This is not necessary under the provisions of the Metalliferous Act; but as the industries overlap in many of the

districts, all inspectors up to the present time have been holders of certificates of competency under the Coal-Mines Regulation Act. Also, notice that, under a certain section, an inspector is required to visit every working place, every roadway and travelingway in a mine every month.

By the Metalliferous-Mines Inspection Act, the mines are inspected under similar conditions. The small mines are not examined oftener than once in two or three months. Under the Coal-Mines Regulation Act, the inspector is required to post a notice of his inspection at the mouth of the mine, stating conditions. Also, in addition to this he must attend all inquests. He is also a member ex-officio of all regular examining boards for issuing certificates to coal miners, but without a vote. He usually attends the monthly meetings of the board. The powers given in Section 79 of the act are exceedingly broad, authorizing an inspector to close a mine for cause at any time. I might add that this clause is rarely used unless every effort of moral suasion fails to bring about the change required, in which case we do not hesitate to resort to all the powers given under that section.

In British Columbia, in the year 1915, there were 16 collieries, operating in all 28 mines. The number of men employed underground was 3,250. The officials of these mines, sixteen in number, were holders of first-class certificates of competency to act as mine managers and superintendents; twenty-eight other men were holders of second-class certificates; 264 firebosses and shotlighters were holders of third-class certificates, making in all 308 holders of certificates. There was, therefore, one certificated official for every eleven men employed underground in these mines.

In 1915, the total number of employees in and around coal mines, both underground and above, was 4,991, and in the metal mines 4,144, making a total of 9,135 men employed in these two industries in British Columbia. There are seven inspectors outside of the chief inspector, which makes one inspector for every 1,305 men employed in and around the mines.

Notwithstanding this apparent very efficient examination of mines, not only by company officials but by in-

spectors, I am sorry to say that our records of accidents, per thousand persons employed, is far from being a good record. The proportion per thousand persons employed, during the first ten years, in coal mines was 4.7 per cent.; metalliferous mines 4.4 per cent. The accident rate in coal mines was much augmented last year by a disaster that caused the loss of 41 lives, and the proportion is 10.4 as compared to 4.4 of the previous year.

British Columbia is practically one sea of mountains. The geological conditions are, therefore, not favorable for safe mining. In many instances in an area not exceeding three or four acres a coal seam will vary from dead level to nearly vertical. The topography of the country is usually a good indication of the underground conditions. The geological disturbances that have taken place in it have distributed the slates and shales in a highly slickenside condition, and they are very dangerous.

After a careful study of the conditions in the Province of British Columbia, I have come to the conclusion that legislation, however stringent, and supervision, however frequent and efficient, will not entirely eliminate accidents in coal mines.

I was much impressed a few weeks ago by an article in *Coal Age* which expressed the gist of the matter in a few words. The statement was made that "accidents in our coal mines will never reach the required minimum until such time as the miner is as safe as the mine." Now at the present time in the Province of British Columbia, and I presume it is the same in every state in the Union, probably not 10 per cent. of the men give any attention to the question of safety first in coal mines, and that proportion will never reduce the accident rate to the required minimum. If we could reverse the ratio and have 90 per cent. of our men trained, instructed and interested in the safety-first movement, then I think we might bring the accident rate down to the required minimum.

There are many difficulties to be met in bringing about such a condition of affairs, and I think not the least among them is the widely disseminated idea that there is nothing in common between the employer and his employees. Certainly, it appears to me that where the question of the

conservation of life comes in there should be some neutral ground where the employer and employee could meet for the good of all concerned.

The president then announced that the next paper on the program was one on "Efficiency in Mine Inspection" and Doctor Rutledge responded by reading the following, which he had prepared:

WHAT CONSTITUTES EFFICIENCY IN MINE INSPECTION

By J. J. Rutledge*

The Standard Dictionary gives the following definitions of efficiency and inspection:

Efficiency: (1) The character or quality of being efficient; the power that accomplishes a desired or designed work; the quality that produces the best business results or the most effective service; effectiveness; as, the efficiency of an agent. (2) (Specific) (a) the state of possessing adequate skill or knowledge for the performance of a duty or calling (b) (Mech) The ratio of useful work or the effect produced to the energy expended in producing it.

Inspection: (1) The act or process of looking into; especially, a careful, critical investigation or scrutiny. (2) An official examination by persons appointed for the purpose.

With these definitions in mind I will speak briefly on this subject that is of such deep interest to us all.

Mine Inspections—There is urgent need for an inquiry into those conditions existing in our mines that make for safety of life and the conservation of health of all employees in and about the mines. Such inquiry or inspection should be made by some person who has received his authority from and is backed by the police powers of the state. An inspector should be capable of performing his work of examining a mine and should be thoroughly honest and possess sufficient courage to make the conditions that he finds to exist therein known to all interested. The mine owner and his representatives have one interest, while the miners and other employees have another interest. Both are honest in their convictions, but both are interested parties. A proper inspection of the mine and an unbiased statement of the conditions disclosed thereby can only be made by a disinterested person whose chief

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purpose is to satisfy his own official conscience as to the safety of the mine and its surroundings.

That such inspections are desirable and necessary is evidenced by the fact that nearly all large coal-mining companies have their own company inspectors, who generally report to but one official of the company, usually the general manager, and are responsible to him alone, and receive instructions solely from that official. A private inspector is, as a rule, entirely independent of the operating department.

Efficiency in mine inspection requires: 1. A good mining law drawn to fit the peculiar conditions in the state. A mine inspector can not enforce his recommendations in regard to safety, unless he has been given certain police powers by the state mining law. In some instances, through sheer force of character, mine inspectors have enforced recommendations that were not contained in the state mining law; but such cases are rare. A well drawn mining law, generally and impartially enforced is essential to efficiency in mine inspection.

2. A capable, honest, faithful and courageous mine inspector is needed. The mine inspector must possess all of these qualifications, in my judgment, in order to be able to make efficient inspections; and, in addition, he should be of a judicial temperament and should never take a side in disputes, or be guilty of showing partiality to either of the contending parties. He should be able to discriminate between bona-fide and bogus complaints.

3. Every inspection should be made according to an established system that will show all the conditions, good and bad, in the mine and about it. An officially signed statement of the conditions found to exist in and about the mine should be posted near the mouth of the mine.

4. The mine management and employees should cooperate in enforcing any orders of the mine inspector and in maintaining proper mine discipline. Unless these two interested parties coöperate in the endeavor to remedy or eliminate dangerous conditions the inspector's recommendations will not bear fruit.

These are, in my opinion, the human elements that enter into an efficient mine inspection. Another requirement

is a good blueprint of the mine map, folded to fit the pocket and drawn to a good working scale, showing all the mine workings, both live and abandoned, the course of the ventilating current, and the manner in which it is conducted through the mine, all haulage roads, airways, manways, pillar workings, etc. The inspection should be made in a careful and painstaking manner.

The results of the inspection should be recorded by some standard plan of reporting mine inspections, which will eliminate as far as possible the personal equation of the inspector, and will permit a true comparison of the results of the inspection of one mine with those of another.

An inspection should include a search for the presence of inflammable coal dust, the occurrence of gases, and evidences of the improper or dangerous use of explosives.

I have been informed that the boiler-inspection laws of some states require the inspection of a boiler while it is under construction. Also, that the new code of the American Society of Mechanical Engineers requires that boilers be constructed of certain standard material and in a uniform manner. It would be well if our mining laws required the development of mines only along certain definitely approved plans and that these plans be so approved before the mine development was begun.

The Results of Locomotive Boiler Inspection

Kindly permit me here to refer to a few facts showing what has been accomplished both at home and abroad by an efficient system of boiler inspection.

The annual report of the chief inspector of locomotive boilers for the fiscal year ended June 30, 1915, has just appeared. The report shows that in the last four years of service the annual number of accidents has been reduced from 856 to 91; the number of persons killed by such accidents, from 91 to 13; and the number of persons injured, from 1,005 to 467. Even during the past year 32,666 locomotive boilers and their appurtenances have been found defective, and 2,027 were ordered out of service. In the face of facts like these, there are those who still oppose such inspection and supervision as an unwarranted interference of individual rights.

In the entire Empire of Germany, not including boilers used in the military and naval service, there were in the year 1914 only eight explosions of steam boilers. One of those boilers was built in 1873, one in 1874, one in 1880, one in 1881, one in 1892, one in 1902 and two in 1906. I mention the dates as showing that all of these boilers were well along in years; one-half of them having served more than a quarter of a century. Low water is given as a probable cause in five of these eight cases. In three of the explosions no personal injuries were caused, while five persons were killed in the two remaining ones, which seriously injured two and slightly injured seven other persons.

In the same period there occurred, in the United States, 575 accidents to boilers, by which 300 persons were killed and 476 more or less seriously injured.

After reading his paper, Doctor Rutledge continued:

I think, Mr. President, it shows just as much judgment to require a man to submit a plan of mining work before opening up a mine as it does to require a plan for a building to be submitted by a building contractor for the approval of a competent board. We require plumbers, masons and contractors to submit their plans, yet we permit men to open mines and jeopardize lives without submitting plans. So far as my research has extended, I have been unable to find mention of such a requirement or any provision in our laws relating thereto.

Not long ago I had the opportunity of reading some discussion that arose with the chairman of a committee who was introducing into this country a uniform system of construction and inspection of boilers. The American Society of Mechanical Engineers, boiler makers and boiler inspectors got together and formulated a proposed code of construction and inspection of boilers. All this work they did voluntarily. It has been estimated that had this work been paid for at the rate usually paid for such work, it would have amounted to four million dollars.

After several years' work they prepared 5,000 copies of their proposed code and sent them throughout the world, with the request that others submit their suggestions,

comments and criticisms. In response to that request 5,000 comments and criticisms were received. After some months these comments were classified, the desirables accepted and the undesirables rejected, and incorporated in another proposed code. Then a second draft was sent out to all interested parties. This time, 500 comments came back, and those that were thought desirable were accepted and incorporated in the code, while the undesirable ones were rejected. The result is the code that is now being used by the American Society of Mechanical Engineers at the present time.

MR. DUNLOP (*Illinois*)—I don't like to let Doctor Rutledge get away without some criticism. He has told us that when building a hotel we would have an architect draw a plan and submit it to the inspector for approval. That is something we can see, but he knows full well that in all coal fields many changes occur and that it would be impossible to draw plans in advance and carry them out fully. There are things underground we cannot see and the plans must be changed accordingly. I am satisfied he knows that is correct.

MR. RUTLEDGE—But, we know well enough it should not be opened on a single-entry plan, which in many cases is done today.

THE PRESIDENT—I think Doctor Rutledge realizes the limitations of what he has suggested, which appeal to us all, I believe as a wise and much needed provision. And, now, we would like to hear from Mr. Back on "Safety in Underground Haulage."

SAFETY IN UNDERGROUND HAULAGE

By THOMAS P. BACK*

I want to first speak of haulage on main roads and consider how it should be conducted so as to be safe.

Haulage Roads—Props and refuse should be kept at a safe distance from the side of the cars on all roads. The law of Illinois provides that one side of the track shall be kept clear of all refuse or gob for a distance of 2½ ft. from the rail, but that does not refer to standing timbers or props. In entries that are driven 8 ft. wide,

*Mine Inspector, Canton, Ill.

with a 3½-ft. gage and a 2-ton car, overlapping the wheel 6 in. on each side, to lay the track in the center of the entry only allows 21 in. of clearance on each side of the car, which would not comply with the law, to do which the track must be pushed over 9 in. beyond the center. This might do for mule haulage, but I do not believe it would be safe for electric-motor haulage where trips are run from 10 to 15 mi. per hr., with a 10- to 15-ton motor, and I would recommend that where motor haulage is employed the haulage roads should be driven so that there would be at least 2½ ft. clearance on each side of the cars and that both sides of the track be kept clear of all refuse.

Room Haulage—In room haulage I find props are often set so that the cars rub them. Props should be set so as to give a clearance of at least 6 in. on each side of the car. A great number of accidents occur to drivers whose hands are frequently crushed between the corner of a car and a prop. Wherever props are required to be set close on account of roof conditions, crossbars should be used and the posts stood further back.

Slope Haulage—Wherever ropes are used in slope haulage, separate traveling roads should be used for the men entering and leaving the mine.

Electric Haulage—Wherever electric power is used all wires should be protected by boards or otherwise where men or animals must pass under. Where electric power is taken down the shaft, the wires should be properly incased or insulated, although there is nothing in the law requiring this.

Continuing, Mr. Back said: A question was asked the other day in regard to an assumed advantage of gasoline motors over electric motors. I wish to state that I would not allow a gasoline motor working on intake air in any mine of which I had charge. I did not order them taken out of the Springfield district where they were doing good work; but the carbon dioxide produced has made it necessary to take out several machines working on the intake airways. I don't think a gasoline motor should ever be permitted to work on intake air.

Mr. Scollard (*Indiana*)—What kind of markers are used on the rear end of trips of cars?

Mr. Back—Most of them use tripriders. Where they do not, they hang something on the last car of the trip. Some use a light while others use a piece of metal for a marker. The metal is sometimes painted white.

Mr. Scollard—We are now considering that question in our state, and the use of lights has been recommended. But sometimes a car breaks loose, the light is extinguished and the noise of the trip going out is confused with that made by the car broken loose from the trip, even though a metal marker is on the car.

Mr. Reid (*Illinois*)—In my district they use both lights and markers. They use a gasoline torch, and the light is much safer than a marker. We had two or three accidents occur where we had a marker on the last car and a motor ran into the car and killed the triprider. The torches are placed at a switch, and a triprider, when he throws the switch picks up the torch, which shows whether a trip is out or in. The majority of trips use a marker.

Mr. Scollard—But no light?

Mr. Reid—Either one or both.

Mr. Scollard—Where you use motors, do the motors with trolley poles enter the rooms or do you use the gathering motors with reels?

Mr. Back—Some of the mines use a gathering motor, but they generally use the reel.

Mr. Reid—All haulage motors in our state work with a wire and trolley pole. The gathering motors all use storage batteries.

Mr. Scollard—In our state we use trolley motors for gathering purposes, but they have only one trolley pole, which often necessitates the wire crossing the mouth of the room. For instance, if you had a right-hand trolley pole up in the aircourse, your trolley wire would necessarily be along the pillars; the right-hand trolley pole going to the entrance would have to be across the entrance. That puts the wire down over 10 inches and every time a man comes out it necessitates going under that and lifting the trolley wire. I have recommended the use of the two trolley poles.

Mr. Flynn (*Alabama*)—The Tennessee Coal, Iron and Railroad Co. use two trolley poles.

Mr. Scollard—We have no law governing the case, but we require that no motors be installed without our consent.

Mr. Reid—I claim that one trolley pole is much safer than two. We had one man electrocuted on a two-trolley-pole motor. He pulled the pole down from one side, put it under the hook, put the other pole on and failed to switch the current off the pole he pulled down; he got in the motor, started to run it and was electrocuted.

Mr. Scollard—What voltage is used?

Mr. Reid—We use voltages of 250 and 500; in the case I just mentioned the pressure was 250 volts.

Mr. Scollard—You spoke of a 2½-ft. clearance.

Mr. Back—Yes, 2½ ft. from the rail. Many of our mines use a 42-in. gage and the car extends out over the wheel probably 6 in., giving less than 2½ ft. clearance.

The President—I believe the next thing in order is the selection of the place for our next meeting.

The Secretary—I have received no invitation from any of the coal-mining cities. I had rather an informal letter from the Chamber of Commerce, of the City of Baltimore, requesting that we hold our next meeting at Baltimore. They seemed to have the impression that the Institute had four or five thousand members and that it would be a financial gain to have us come to their city.

The President—I think we should hold our next meeting in the place that is most convenient for the largest number of our members and where we will have the best meeting, from a business standpoint. We shall be glad to hear from the members present in regard to their choice of a meeting place.

Mr. Nesbitt (*Alabama*)—I move that we meet next year at Chicago. That is a central location and easily reached.

The President—We should discuss the matter and get the opinion of all present as to their preference.

Mr. Flynn (*Alabama*)—We have held our last two meetings here in the West. Last year we met in St. Louis

and this year in Joplin. Although the St. Louis meeting was not held in Illinois, still the Illinois inspectors and operators took the leading part in making it a great success. I want to nominate as our next meeting place Columbus, Ohio.

THE PRESIDENT—Mr. Graham, have you any suggestion to make in regard to the place for holding the next meeting?

MR. GRAHAM (*British Columbia*)—I think, Mr. President, that the point raised by Mr. Flynn is well taken. The last two meetings of our Institute have been held purposely in the West, with the idea of attracting some of the Western States, who have never responded to the invitations to meet with the Institute, and coöperate in our movement. After meeting last year in St. Louis we came this year still further West, purposely, I think, to give our members an opportunity to visit this very interesting field, and I believe it was a good idea. However, it has failed to bring about the main object desired, which was, to attract inspectors from the far Western States. We have had no more response from them, however, than when we met in the far East.

It is extremely difficult for a state with as many inspectors as Pennsylvania, Ohio and West Virginia to be extensively represented at this distance from their scene of operations. For that reason I suggest that we had better, for a while at least, confine ourselves to the Eastern States, where a large number of our members are located. It appears to me that Columbus or some other central point, or even a place in the anthracite region—Scranton, Wilkes-Barre, or perhaps Philadelphia—would be a good place.

MR. REID (*Illinois*)—To show our interest in the Institute I will put Peoria, Ill., in nomination.

THE PRESIDENT—It seems to me that Mr. Graham's suggestions are good. We have been meeting now two years in the West, and we met last year so close to Illinois that it might seem better to get back nearer to the large bulk of our coal next time.

MR SCOLLARD (*Indiana*)—I want to invite the Institute to meet next year at Indianapolis.

Mr. Dunlop (*Illinois*)—I don't know what Mr. Reid is thinking about. He knows well enough that the Illinois operators helped us out in last year's meeting, and I feel we should not go back there so soon again. We have just heard the invitation of Mr. Scollard, chief mine inspector of Indiana, to come to Indianapolis, which you will remember is where the Institute was born.

Mr. Scollard—If you come to Indianapolis, I will see that the Institute is well entertained.

Mr. Flynn—As the next convention is the tenth annual convention of this Institute and, inasmuch as Indianapolis was its birthplace, I withdraw Columbus in favor of Indianapolis. I think it would be a good idea to go back there and show how much the Institute has grown in nine years.

Mr. Nesbitt—I will withdraw Chicago in favor of Indianapolis.

Mr. Reid—I will withdraw Peoria.

The president then put the question to vote and by unanimous vote it was decided to hold the tenth annual meeting of the Institute at its birthplace, Indianapolis, beginning the second Tuesday in July, 1917.

The President—I believe we have now finished our business except the election of officers for the coming year. I will ask the tellers if they have counted the ballots to announce the results of the election.

Report of Tellers

Mr. Dunlop (*Illinois*)—On behalf of the tellers, Mr. President, I have the honor to announce that the following persons have been elected officers of this Institute for the ensuing year:

President, Thomas Graham, Victoria, B. C.

First vice-president, L. D. Devore, Bellaire, Ohio.

Second vice-president, Rees H. Beddow, Gallup, N. M.

Third vice-president, Charles H. Nesbitt, Birmingham, Ala.

Secretary, James W. Paul, Pittsburgh, Penn.

Assistant secretary, Thomas Kanary, St. Charles, Mich.

Treasurer, P. J. Moore, Carbondale, Penn.

Editor in chief, James T. Beard, New York, N. Y.

Mr. Graham—I desire to thank you for the honor you have conferred on me today by electing me president of the Mine Inspectors' Institute of the United States of America. I assure you I appreciate this distinction very highly. I have not ego enough to think that this comes to me through any personal work or ability that I have displayed, but on account of the great interest that the Department of Mines in my province has taken in the work of this Institute in sending me to your conventions in the hope of learning of ways and means by which we may advance the industry in our province. I assure you that I shall endeavor to carry out the work of the Institute the coming year with the same efficiency my predecessors have shown. I again thank you.

Mr. Nesbitt—I want to thank the members for the honor of election to the office of third vice-president.

Mr. Flynn (*Alabama*)—I move we adjourn *sine die.*

Mr. Dunlop (*Illinois*)—Before we adjourn there is a matter I want to bring up that I have talked over with Mr. Paul, who wrote me during the year about some company who wanted to use our report for advertising and pay us a percentage of the proceeds. In talking over the matter we thought it might be well to do that. I believe that it can be done with justice to ourselves and it might help us to pay the expenses for entertainment during the meeting. We were trying to avoid the necessity for our committees having to go out and solicit for the entertainment.

Mr. Flynn—I am opposed to using our reports as an advertising medium, although we might be able in that way to raise something financially. A report looks bad all interspersed with advertising—you lose interest in it and throw it to one side; the majority think it is nothing but advertising and do not read it. We are not financially embarrassed and I see no reason why we should detract from the appearance of our reports by filling them full of advertising matter for the sake of a little financial benefit. I move that no advertising be inserted in our reports.

Motion seconded.

Mr. Dunlop—I feel that one drawback to holding our meetings is the cost of the entertainment. This is a

burden that must be borne by the city where we go. I feel that the Institute should be self-sustaining, and this might be accomplished in the way I have suggested.

Mr. Nesbitt (*Alabama*)—I appreciate what Mr. Dunlop says. It is disagreeable to have to raise funds, yet somebody has to do it. But referring to the success of advertising in a periodical such as the report we issue, that success would be based on the circulation, which in our case is small. If every inspector in the United States —I don't know how many there are (Mr. Paul, 215) should get this report, the circulation would not be great. Then again, inspectors are not in the market for anything; if it were going to the operators it would be different. I do not think one would be very successful in soliciting advertisements unless the circulation was 5,000 or more.

Mr. Holland (*Iowa*)—I am a young member in this Institute, but my personal observation has been that as an organization for the conservation of human life and education of its members, for which purposes the Institute was established, there has been too much entertainment and not enough discussion. The business of the Institute has been crowded out of place for entertainment. I believe it would be better to have less entertainment and more business.

Mr. Graham (*British Columbia*)—I am very much in sympathy with what Mr. Holland has said. I feel that we have had too much entertainment to the detriment of our work, which many of us have come ready to perform. I am also in sympathy with Mr. Flynn's idea in regard to the report. I do not think it would be well to load our report with advertisements, which might not be acceptable. I think we should rise above that and keep our report clear from advertising of any kind.

The Secretary—From time to time people have come to me as secretary of the Institute and wanted to make some arrangement whereby we would publish a certain amount of advertising matter in our proceedings, claiming that they were in a position to solicit advertising matter and would do all the routine work in connection with it, preparing the cuts and advertising matter, and

would permit the proceedings with the advertising matter to be published under the direction of the Institute. Some have gone so far as to ask for the use of my name as secretary of the Institute in that connection, which I have always refused, for the reason that I had no authority to do so.

I was interceded this year by a man from Chicago, who endeavored to make an arrangement with me or the Institute, allowing advertising matter to be published in the proceedings of this meeting. I took it up with the members of the executive board, and I think they are unanimously opposed to it, unless the Institute authorize such step.

The expenses of the Institute have been rather moderate, and no doubt the costs of our entertainments have amounted to two, three or four times these actual expenses. The Institute is able to take care of itself from its receipts, provided we do not go in too liberally in the publication of our proceedings. I would not be willing to go into a matter of the kind suggested, except as an experiment, if the Institute felt so disposed. But the motion of Mr. Flynn will, I think, settle the matter.

The president then put the motion to exclude all advertising matter from the proceedings of the Institute and there was no dissenting vote.

THE PRESIDENT—It has been unanimously decided that our reports shall be published without any advertising matter.

MR. FLYNN—I move again that we now adjourn *sine die*.

Motion seconded and carried.

Editor's Note—Let every member boost the decennial (1917) meeting of the Institute, by urging a full attendance at Indianapolis and sending new applications for membership to Secretary Paul, 704 Empire Building, Pittsburgh, Penn. Don't wait, but Do It Now. Every mine inspector—state, province or county—and persons commissioned by the Federal Government as director or chief of division of Bureaus of Mines, in the United States and Canada, including both coal and metal mines should be members of the Institute, and all such are invited to join and be present at the Indianapolis meeting, beginning July 10, 1917.

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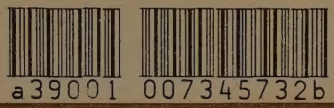

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